

"I still don't know why we didn't hit him" 99



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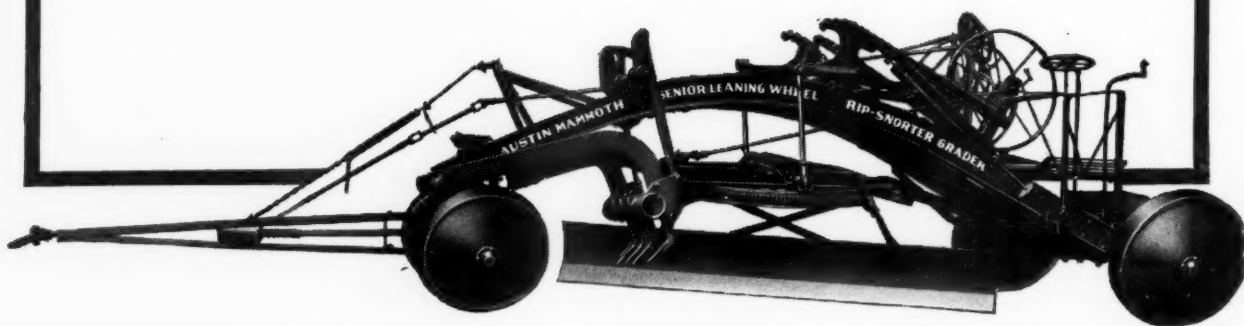
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MARCH, 1931

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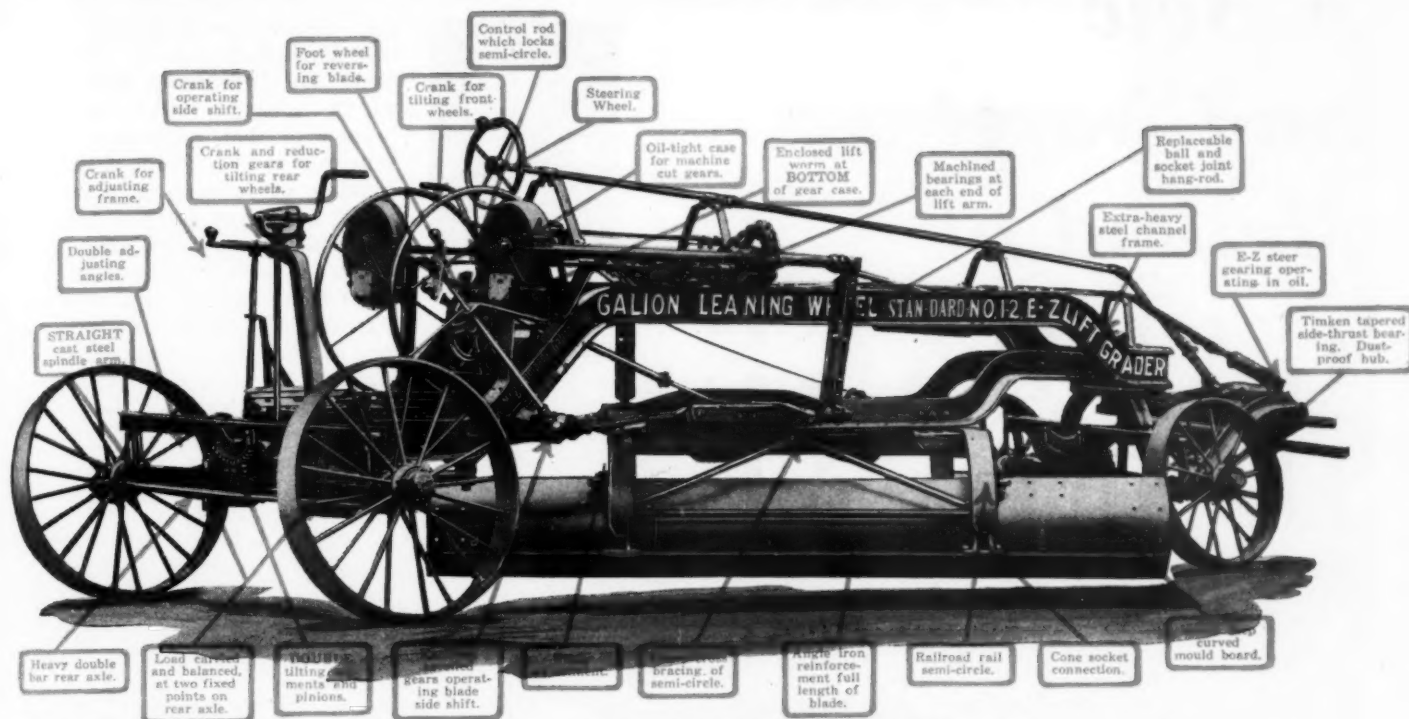
axle. It will work behind the most powerful tractors and tear up worn-out road or rough subgrade and regrade in a single operation. Such *special advantages* enable road officials to make better records and contractors to cut costs.

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With Our Authors



S. P. LONGSTREET began his highway experience with the Pennsylvania Department of Highways on December 1, 1911, and has been with that department continuously to the present date. Beginning as rodman on a survey party he served later as instrument man, party chief, draftsman, inspector on construction, as well as assistant engineer in charge of construction, until in January, 1920, he was appointed district engineer in charge of maintenance, planning and construction in a district comprising five counties in the northeast section of Pennsylvania, of which Scranton is headquarters. From January 1, 1920, to May 15, 1923, he held this position and, later, a similar one in the Philadelphia district, including five counties in the southeast section of the State. In 1923 he was appointed division engineer, which position carries about the same responsibilities as district engineer but over considerably increased territories, and this position he holds at present.

Chas. H. Kuhn is city engineer of Fort Thomas, Kentucky. He is twenty-nine years old, a graduate of the five-year cooperative course in civil engineering given by the University of Cincinnati, class of 1925. While there he had a varied experience in engineering work. After graduation he spent a short time in the maintenance of way department of the Pennsylvania Railroad, and has for the past five years been with the engineering department of the City of Fort Thomas, being assistant city engineer during the building of the disposal plant which he describes in this issue.

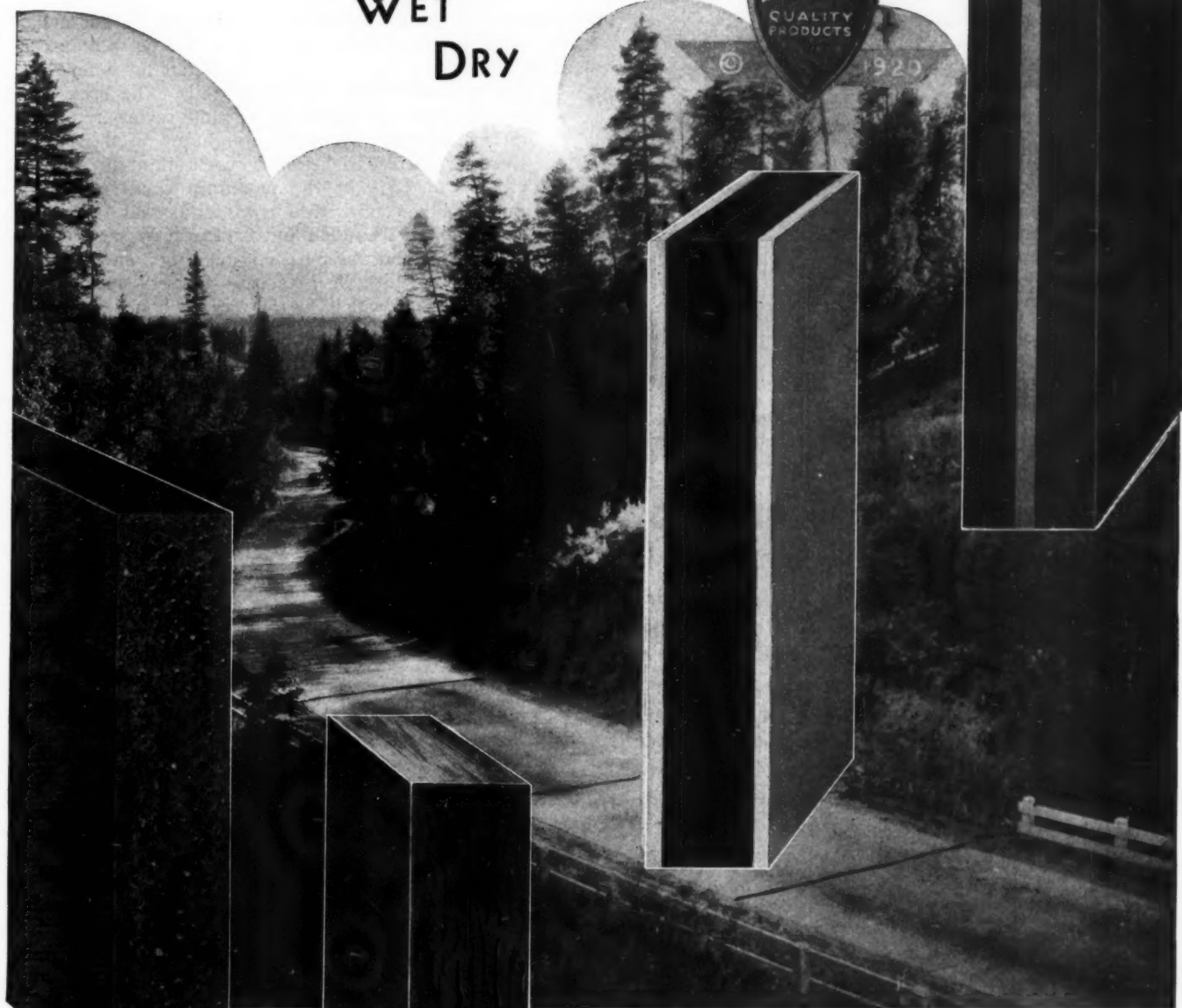
Most of the authors whose articles appeared in the February issue have already been introduced to our readers. George E. Martin, consulting engineer of the Barrett Co., was the subject of a short sketch in May, 1930. J. F. Coleman, chief engineer of the Southern Region, National Paving Brick Mfrs. Association, was introduced in June, 1930. We have been trying to get a picture of Mr. Coleman for a long time. Too modest. We tried to call on him down in Atlanta last month, and are sorry we missed him. W. Hoenig is maintenance engineer of the Wisconsin Highway Commission. John Simpson is a regular contributor on legal matters. G. M. Ridenour of the New Jersey Agricultural Experiment Station, was mentioned in the August issue, 1930. George B. Gascoigne is a consulting sanitary engineer of Cleveland, O. Isador W. Mendelsohn and A. E. Clark have been mentioned in preceding issues.

There are several new faces among our March contributors. Among these are C. H. Purcell, state highway engineer of California and chairman of the committee on allowable grades of the American Road Builders' Association, and P. E. White of Lebanon, Pa., a B.S. in sanitary engineering. C. E. Keefer, is engineer of sewage disposal, Baltimore, Md.

H. Heukelekian is research bacteriologist in Sewage Disposal of the New Jersey Agricultural Experiment Station.

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Book Reviews

The World Was Seventeen. By Marie Sherman Cary (Mrs. H. Burdett Cleveland). The Century Co., New York. \$2.

Mrs. Cleveland, who is the wife of H. Burdett Cleveland, a well-known consulting sanitary engineer of New York City, has published her first novel. We are not going to tell here, even in an abbreviated form, the story, but our readers will be well justified if they lay aside *PUBLIC WORKS* for a few hours and read the story she has to tell. The book shows a real gift for description; this reviewer (reader, rather, in this case) was brought up in the country. Reading Mrs. Cleveland's book brought back so vividly the life of the mountain country, and the charm of the countryside in winter as well as in spring and summer, that his mind isn't exactly satisfied with the prosaic business of engineering; and probably will not be until he gets back for a visit to the old home place, at which, by the way, he hopes to entertain Mr. and Mrs. Cleveland, to show them there are other beautiful places; than the Berkshires, where this story is laid.

Most of our readers feel more or less acquainted with Mr. Cleveland through his many articles in *PUBLIC WORKS*. They will find that the other half of the family also produces material well worth reading.

We are departing from our usual practice in reviewing only engineering publications in this department because engineers and their wives are always interested in what other engineers and engineers' wives are doing, and also because "The World Was Seventeen" is a rattling good book, and well worth reading on its merits alone.

Though the book can be purchased at most book stores, *PUBLIC WORKS* will be glad to handle orders for it from anyone who cannot readily secure a copy.

A Study of the Pollution and Natural Purification of the Illinois River. II. The Plankton and Related Organisms. By W. C. Purdy, Special Expert, U. S. Public Health Service. Public Health Bulletin No. 198. 212 pages; 42 illustrations. Government Printing Office, Washington, D. C. For sale by the Superintendent of Documents, Washington. 45 cents.

This text, the second on the study of the Illinois River, constitutes "an effort to record not only the presence of certain organisms in the water of a polluted stream but also to set forth, so far as present knowledge will justify, the work that such organisms are doing, and the probable net results of such work in terms of stream purification. The presence of 'pollutional' organisms, for instance, means not only that pollution matter is present, but it also means that the proper workmen are on hand to dispose of such material, with ultimate improvement of the water as a logical result. An ally in the good work is found in the great preponderance, at all seasons, of such organisms as produce an excess of oxygen. It seems reasonable to regard these minute biological workmen as a factor of hitherto unsuspected importance in stream economy, hence the prominence accorded them in certain tables, and in the text as well."

Alloys are Allies of Progress

What would our grandfathers say of this age of roads in the sky, ice by wire and pictures that talk? Alloy irons and steels, little dreamed of 30 years ago, have made possible the modern airplane, automobile and other wonders of our present day.

The skillful alloying of metals has also played an important part in the development of Toncan Culverts. Toncan has always been of commercially pure iron analysis—in 1921 copper was alloyed with the pure iron—and still later the pure iron base alloyed with a much larger copper content, plus Molybdenum! The addition of these metals has greatly intensified the resistance of Toncan Culverts to soil, water, and atmospheric corrosion. Truly, Alloys are Allies of Progress.

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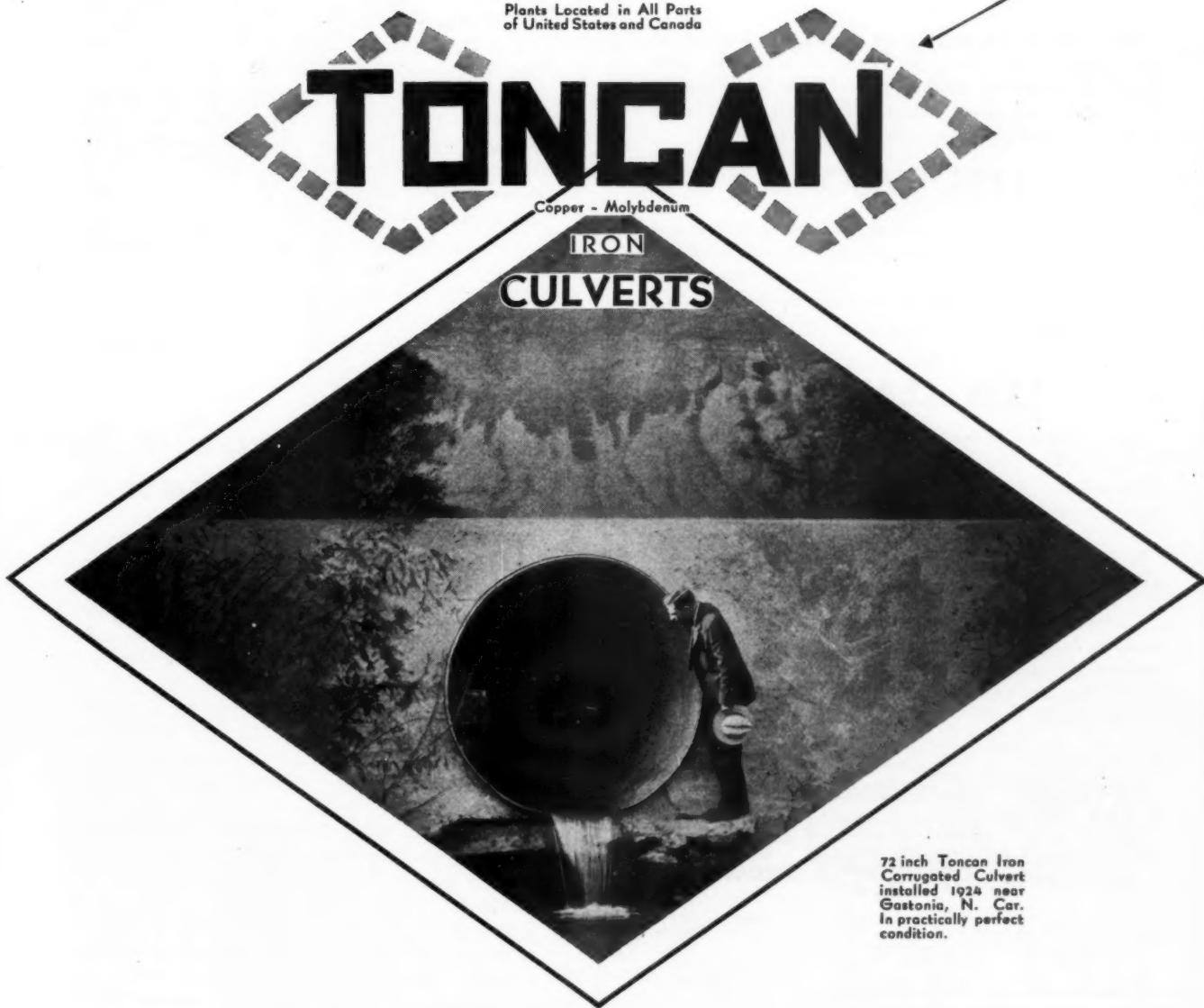
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A number of photomicrographs are shown in the text in order to acquaint the reader with the predominating organisms (other than bacteria) concerned in biological purification.

This study is the biological portion of the investigation of the Illinois River carried out by the U. S. Public Health Service under the supervision of Sanitary Engineer J. K. Hoskins, and a part of the extensive studies of polluted streams. This report was preceded by reports of the bacteriological and chemical studies.

Written in a clear and interesting style, and replete with information every sanitary engineer ought to have at hand, this text should have a place in every library.

U. S. Cast Iron Highway Culverts. 28 pp., illustrated. The U. S. Pipe & Foundry Co., Burlington, N. J. Free on request.

This valuable little book tells something of the suitability of cast iron culverts for use under costly, permanent roads. Considerable information of value is given, covering the result of crushing tests, sizes and weights of culverts desirable, methods of installing, and other data.

A Study of Concrete Road Joints.—The Flexible Road Joint Machine Co., Warren, Ohio, has published this little booklet which is full of valuable information for anyone who has to build joints in concrete roads.

Gas Lines With Welded Pipes.—52 pp., illustrated. The A. O. Smith Corp., Milwaukee, Wisc. The material in this text should be of particular value to anyone who wishes quickly to estimate pipe line costs for various combinations of pressure, volume and dimensions. The most economical combination of diameter, pressure, and weight can be solved with little effort and time by means of the data in this text.

Lukenweld Construction.—20 pp., illustrated. A description of the modern, efficient and economical method of manufacturing units for machinery and equipment. No patterns are needed, blue-prints being sufficient for guidance. Weight is reduced; time is saved.

Economic Justification of Bituminous Surface Treatments

THE North Dakota Highway Department, in its January "Bulletin," describes the method of calculating the relative economies of different grades of pavement by comparing total annual cost with the total saving to traffic and other advantages of higher-cost pavements. It bases the saving to traffic on the conclusion of Prof. Agg that it costs approximately one cent less per mile to operate an average car on a well graded and drained road than upon an unimproved road, and that the cost on paved roads is one cent less than on gravel surfaced roads.

Using North Dakota data and costs, it is calculated that the total interest and maintenance charge against gravel averages \$1050 per mile per year, and against paving averages \$3006.22, or a difference of \$1956.22. At a saving of one cent per vehicle-mile, it would require that 195,622 vehicles pass over this road per year to make the paving economically advisable. This averages 530 a day, which, according to estimates of the department, means 800 to 850 a

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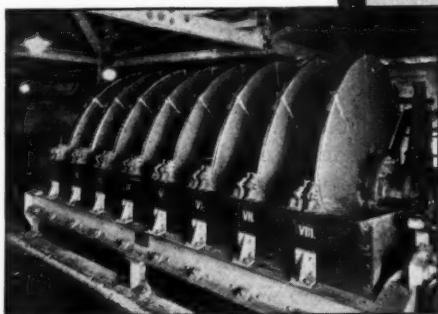
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day in summer, when the traffic counts are usually taken.

This calculation was based on a pavement costing \$34,000 a mile in addition to \$8,000 for grading and previous gravel used as a base. But before traffic warrants such an expenditure, it may be economical to apply a surface better than gravel but costing much less than \$34,000 a mile—that known as bituminous surface treatment. The statement of the department on this point is as follows:

“Such surface treatments are comparatively new; so new in fact that only a small percent of the people are familiar with them, and traffic costs and maintenance costs are not as definitely known as on other types. But their development has been so great that today we do not perhaps realize their full value. Today we find miles of these various types of surfaces carrying traffic as satisfactorily as pavement. Just what their traffic limit is cannot be accurately determined at this time. For their success they require a substantial grade that does not get softened up by moisture at any time during the year. With our soils a wide and high grade seems to be the solution, as our soils are quite stable, when kept dry. The other essentials are a properly graded, durable aggregate and a suitable bituminous binder. Good binders are available as tars, oils, emulsions, cut backs or asphalts.

“Roads of these types, well constructed with the proper kind of aggregate and the proper type of binder, are satisfactorily carrying a traffic today that was not believed possible for anything but a pavement until they actually demonstrated that they could do it. They are dustless and have better riding qualities than many pavements, and vehicle operating costs cannot be far if any higher than on pavement.

“The oil-gravel mix type twenty feet wide and two inches thick cost last year approximately \$3600 per mile. Wider or thicker surfacings will of course cost more, and costs will be higher where gravel is more expensive. So we will assume their cost at \$5000 per mile for purposes of comparison. The grading and gravel cost under an oil mix surfacing will be assumed the same as for pavement—\$8000 per mile. The total cost will then be \$13,000 per mile, against \$42,000 per mile of pavement. And as the surfacing is dustless, pleasing to ride upon and gives approximately the same vehicle operating cost, we are getting the same value for approximately 31 per cent of the investment. The maintenance costs of these oil-gravel mix surfaces will not be as high as the maintenance of untreated gravel surfaces, as there is little wear on the gravel, and worn out gravel is a big item of cost in the maintenance of untreated gravel roads. So, until we have a traffic that cannot be carried on a surface-treated road, we can in no way justify the expense of paving, but we can justify surface treatments as fast as funds will permit.

“The best information available to date on oil mix surfacing shows a cost of from \$300 to \$350 per mile for surface and shoulder maintenance. This includes the addition of new oil and the remixing and reshaping when such becomes necessary. But as this cost is approximately equal to the cost of worn out gravel in some parts of our State, it can clearly be seen that, with all facts considered, it is cheaper than untreated gravel for heavy traffic; and as it gives practically the same advantages as pavement up to its traffic limit, it must be considered ahead of pavement as the economy is so apparent.”

PUBLIC WORKS

An Engineering and Construction Journal

City

County

State

VOL. 62

MARCH, 1931

NO. 3

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The Water Wheel:

A number of good suggestions have been received in response to our request in the January issue for a name for the Monthly Water Works Digest. The one that finally took the eye of the Editor was *The Water Wheel*, which was submitted by A. C. Fickes of the Lancaster Iron Works, Lancaster, Pa. There were a number of suggestions along the same line, differing only in spelling, and also a wide variety of titles along other lines. Among those in the final heat were Roy S. Lanphear, Francis D. West, E. Bender, Joseph A. Kenney and C. H. Tozzer. Mr. Fickes is hereby officially declared the winner.

Is Business Picking Up?

It looks so. One item. During 1931 so far we have received 24% more requests for the catalogs listed on pages 99 to 106 than we did during the corresponding period of 1930. In the 21 days since the February issue went into the mails we have received more of these requests than we have ever received from any one issue of *PUBLIC WORKS*. If you want the latest dope on new equipment or materials, or if your file needs bringing up-to-date, join the procession. We're glad to be of service to you.

This Issue:

As we look at the well-filled column on the left we wonder if the quality of the material published there is not, perhaps, one of the reasons why more and more engineers and contractors take the trouble to write in to us; and also, perhaps, why they make use of our various facilities, such as the catalog listing mentioned above. See page 35 for a little dope on how our readers feel.

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CITY CLERK'S OFFICE
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CITY

COUNTY

STATE

AN ENGINEERING AND CONSTRUCTION MONTHLY

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No. 3

Curing Concrete Pavement Bases

Practice of several hundred cities in all parts of the country, as indicated by recent information from officials. Ponding, sprinkling, and other use of water; covering with earth, burlap, or asphalt; use of chemicals.

IN building concrete pavements, as well as walls and other structures of concrete, it is the almost universal practice to insist on protecting the concrete for several days from the drying effect of air and sun. But for some reason a considerable number of cities fail to take such precautions with concrete pavement bases, although these are more fully exposed to the

sun than almost any other structure. Considering this, we are inclined to wonder that there are not many more breaks in bases than reveal their presence in base-supported wearing surfaces. As a matter of fact, we believe there are; but their presence is largely concealed by the excellence of the wearing course or especially by the solidity of the sub-grade.

Reports on this subject from about six hundred cities of five thousand population and up were studied. Just about half of these did not use concrete bases; some using black base, some one-course concrete pavements, and some no base at all but confining their paving to bituminous concrete, gravel, etc.

Of more than three thousand cities which use concrete bases, 25% report that they do not use any

Wearing surfaces may come, and they certainly go, but the base goes on forever if properly designed and built, and not too badly abused by trench digging or by a weight of traffic greatly in excess of that expected. But if the base should fail, the surface will fail too, no matter how excellent it may be. A defective spot in the surface alone can be repaired without disturbing the base; but to repair a weak spot in the base necessitates removing and reconstructing the surface above it also. For these reasons the base should be given at least as much consideration as the wearing surface. But is it? This article is an attempt partially to answer this question.

method of protection from drying during the curing period. The cities are quite uniformly distributed geographically, except that none so report from the Pacific coast states.

Of the methods employed in curing, sprinkling with water during several days (generally 7 to 14) is the most popular, as shown in the accompanying table. Other

methods of direct use of water bring the total of this up to 34.6%.

Indirect use of water—covering with earth, sand, hay or straw and keeping these damp—total 23.4%. Prevention of evaporation by covering with a thin coat of asphalt is used by 7.1%. Covering with burlap or canvas, which may be either or both of these two is reported by 10.9%.

Calcium chloride or silicate of soda are used, both by sprinkling on the surface and by incorporation in the concrete. Most of our informants did not specify which, but of those who did the majority used it as a surface application. Use of these chemicals was reported by 18.3% of the cities.

The remaining 5.7% of the cities reported that they

Percentage of Cities Reporting from Each Section as Using Each of Several Methods of Curing

Method of Curing	New England	Middle Atlantic	South Atlantic	E. No. Central	E. So. Central	W. No. Central	W. So. Central	Mountain	Pacific	United States
Sprinkle water	28	15	11	14	14	28	31	25	21	19.0
Pond with water	6	—	11	3	7	4	—	6	14	4.7
Keep wet (method not specified)	—	4	17	3	11	22	23	31	13	10.9
Cover with earth, sand, etc.	22	6	17	8	14	15	30	6	17	12.5
Cover with hay or straw	6	23	5	20	4	2	—	—	3	10.9
Cover with burlap or canvas	16	17	6	13	18	2	—	12	7	10.9
Cover with asphalt emulsion	—	8	—	5	7	9	8	6	17	7.1
Use calcium chloride	11	19	11	22	21	13	8	6	—	15.2
Use silicate of soda	—	—	6	6	—	5	—	—	—	3.1
Method not given	11	8	16	6	4	—	—	8	8	5.7

protected bases while curing but did not specify how.

Several of the methods seemed to be more popular in some districts than in others. Ponding with water, for example, is most common in the South Atlantic and Pacific States. Covering with hay or straw is confined largely to the Middle Atlantic and East North Central States. Asphalt emulsion is most popular on the Pacific and its use decreases quite uniformly as we come east. Calcium chloride finds its peak in the central states, diminishing toward the east and still more rapidly toward the west. There seems to be no general preference between the north and the south for any of the several methods, in spite of the difference in mean and winter temperatures.

Reinforcing

Although perhaps less directly indicative of consideration given to excellence of concrete bases, the use of reinforcement in them is interesting. Of the cities reporting on this point, 58% do not use reinforcement; 13% use it under certain conditions only, and 29% simply report using it. In geographical distribution, the use varies quite uniformly from the highest percentage of those using reinforcement, found in the East South Central states and the East North Central—50% and 47.7% respectively; to the lowest percentage in the Pacific States (16.7) and the Mountain States (18.7%) in the west, and, on the east coast, 44.4% in New England and 37.7% in the Middle Atlantic states.

Of those specifying conditions, 52% use reinforcement chiefly over trenches recently dug; 24% where the subsoil is bad; 8% on recent fills; 8% in business streets; 4% where traffic is especially heavy; and 4% at corners.

Road Designing for Snow Drift Prevention

WHAT North Dakota does to minimize the formation of snow drifts on its highways was told by H. E. Fowler, assistant maintenance engineer of the State Highway Dept., in a recent issue of that department's "Highway Bulletin."

In that state practically all snow storms are accompanied by a strong wind, which also continues for several hours after. It is worse than useless to do any snow removal work until the wind stops—it would only cause deeper drifts on the roads. (The same is reported by A. D. Finch, county engineer of Fayette Co., Iowa.) In many cases this wind can be used as a help rather than a hindrance if provision be made therefor in designing the road; by locating the road on high ground, or on the windward side of hills or ridges or the leeward side of valleys. In fact, Mr. Fowler believes that over most of the area of North Dakota "design can reduce the expense of snow removal by at least 75 per cent and often practically eliminate any drifting on the roadway." Many of the state's highways constructed during the past two years, without any snow fences, are kept free from snow by the wind all winter long without any snow removal work.

One aim is to avoid shallow cuts, especially where they alternate with fills. Cuts from 6 in. to 3 ft.

below the general prairie level are more difficult to keep open to travel in winter than the deeper ones; in the latter a draft appears to be created which tends to blow out the deposited snow.

Guard rails and posts tend to start the formation of drifts.

Frequently a ridge of drifted soil has collected under the right-of-way fence, standing a few inches above the road grade. This tends to start snow drifting and should be removed.

Wide, flat-bottom ditches are desirable, to receive drifting snow.

The maintenance procedure in the fall—in North Dakota—preparatory to keeping the roads open consists of "(1) mowing all weeds within the right-of-way, and beyond where deemed necessary; (2) removing planks on wood guard-rail. (This obsolete type of rail is rapidly being replaced with the wire-rope type on all our projects where installed, due to its hazard to fast traffic, and will be entirely eliminated within the next two years); (3) removing drifted soil ridges under fences; (4) erecting snow fence; (5) overhauling and putting into first class condition all snow-removal equipment; (6) organized snow-removal crews; and (7) arranging for systematic reports to be submitted to district offices from points throughout the district immediately following each storm, etc."

Concrete Paving Records in Kentucky

Eleven firms which contracted for laying concrete pavements for the Kentucky highway commission in 1930 far exceeded in speed all previous records in that state. The greatest number of cubic yards laid with one paver in one day was 642 cu. yds., by Gorrell, Barrow & Kirkpatrick, of Russellville. The greatest number of lineal feet in a day was 1706 ft., by the D. A. Y. Construction Co., of Evansville, Ind. The maximum number of cubic yards per hour was 50.2, continued for 11½ hours by Louis des Cognets of Lexington, and the maximum footage was 142 lin. ft. per hour for 8 hours, by Foster & Creighton Co. of Nashville, Tenn.

The maximum progress in one week was 3,601 cu. yds. in 91½ hours by the D. A. Y. Constr. Co., which company also holds the record for lineal feet—10,223 in 91½ hours. N. E. Stone & Co. of Madisonville made the record for hourly rate averaged for an entire week—42.3 cu. yds. or 120.3 lin. ft.

During the calendar week of August 25th, 12 pavers laid 65,922 lin. ft., or 12.49 miles; equal to 24,466 cu. yds., in a total operating time of 667.75 hours. This is an average of the twelve mixers for the whole month of 36.6 one-yard batches an hour.

A Rex 27-E paver was used by Ellis & Kelly and Nelson Brothers on one of their projects; a Multi-Foote 27-E by Carey-Reed Co., and all other pavers were Koehring 27-E.

For the above information we are indebted to "The Scraper," the journal of the Kentucky Ass'n of Highway Contractors.

Resurfacing City Streets and Roads

There are in America more than 440,000 miles of gravel and macadam roads on the combined state and county systems, which have cost at least one and a half billion dollars; also 109,000 miles of concrete, asphalt and brick surfaces which are gradually wearing rough and uneven under increasingly heavy traffic. While wearing the surface, however, the traffic has pounded down a firm foundation. How to renew the surface and at the same time retain the valuable firm foundation so produced was the subject of the report presented by the Committee on Resurfacing Roads and Streets at the Asphalt Paving Conference at Memphis. This report, slightly condensed, is given below.

DURING the past year this committee sent to approximately one thousand state, county and city engineers, a questionnaire containing the following questions:

1. Has your department salvaged any appreciable mileage of streets or highways by resurfacing with asphalt? If so, give such information as you have available as to original surface and the type of asphaltic surface applied thereto; also size of project, costs, service, etc.
2. What types and methods, in your judgment, have given the greatest satisfaction in your resurfacing work?
3. Have you developed any standard practice in resurfacing? If so, give details.
4. To what extent does your 1930 program include resurfacing projects?

Replies were received from 30 state highway departments, 162 county departments, and 122 cities, a total of 314. These were followed up with further inquiries. The information so obtained furnished the material for this report.

Resurfacing records totaling 45 million square yards, or about 4,000 miles on a basis of 20-foot pavements, were classified as follows:

asphaltic concrete, and 60,000 of penetration macadam.

Original surface asphalt pavement; resurfaced with 3,500,000 sq. yds. of sheet asphalt and 3,000,000 of asphaltic concrete.

In general, the problems of large counties are similar to those of the suburban sections adjacent to the cities in part, and are similar to the state problems in the more outlying areas. Practice, therefore, can be divided into two general groups—urban and rural.

For the rural areas, there are three general classes of resurfacing: 1. On gravel foundation; 2. On waterbound macadam; 3. On old brick and old concrete.

The practice in cities divides itself into two groups: 1. New surfaces on old pavements, which would be further subdivided similar to that outlined above. 2. Replacement of wear on streets. This would be further subdivided into the surface heater method of partial replacement and the cut-out method with complete replacement.



Skin patch surfacing with hot sheet asphalt mixture over old Portland cement concrete in Niagara Falls, N. Y.

Original surface gravel or water-bound macadam; resurfaced with 1,500,000 sq. yds. of sheet asphalt, 8,500,000 of asphaltic concrete, and 9,000,000 of penetration macadam.

Original surface brick, block or cobble; resurfaced with 5,000,000 sq. yds. of sheet asphalt, 3,000,000 of asphaltic concrete, and 50,000 of penetration macadam.

Original surface old concrete; resurfaced with 1,000,000 sq. yds. of sheet asphalt, 10,500,000 of

The returns would further indicate that resurfacing is just beginning on a very substantial mileage of county roads, their main efforts for the past ten years having been to place some kind of a surfacing on the principal highway. In many counties (and this has been quite successfully done) the problem now is to improve the character of the surface to take the increased traffic and to utilize all previous work. In many states the officials are confronted with exactly the same problem.



Warrenite surfacing over old stone block pavement in Troy, N. Y.

Original Surface Gravel

Using gravel foundations, there have been developed three distinct methods of resurfacing:

1. Surface treatment.
2. Retread, or mixed-in-place wearing course, or penetration macadam.
3. Asphaltic concrete or sheet asphalt.

The practice of surface treatment is covered elsewhere in the program and will not be further discussed in this report.

The mixed-in-place method is employed largely in Indiana, Michigan, Virginia and West Virginia and many other states. The practice is to smooth up the original gravel surface by thorough dragging and blading during the spring months of the year. The greatest pains are taken to repair all depressions and weak areas with new material, and to bring the surface to a true line and grade. On this prepared base is then placed crushed stone or gravel to a depth of from 1½" to 2½" loose. Asphaltic material is then applied and the aggregate is mixed and manipulated until uniform texture is obtained, after which it is then smoothed out and rolled. The important points to be considered are careful and thorough preparation of the gravel surface to a smooth contour, and a thorough manipulation of the mixed-in-place course, so that as near perfect uniformity is obtained as possible. From fifteen to twenty complete turns of the surface material are needed. The cost of this type of surfacing varies from 35c to 60c a square yard, according to the availability of materials.

The mixed-in-place surface is for medium traffic, although there are instances where it has successfully carried over two thousand vehicles per day. In general, however, it would be economical for a traffic range of from 500 to 1,200 daily. In view of the fact that a very large percentage of all rural highways carry less than this figure, it can be seen that this type is adaptable to a very large mileage of gravel roads.

For traffic of heavier densities, the asphaltic concrete surfacing has been successfully employed on gravel base, notably in Michigan. This method of resurfacing is employed on high-class gravel roads where the traffic has become too heavy for ordinary maintenance and an asphalt surface is more economical. Heavier maintenance is carried on over the

gravel surface for at least six months to a year prior to surfacing. Good drainage is provided and at least 6" of well compacted gravel should be had. A templet is used to check the cross section, and the surface is then primed at the rate of about ¼ gallon per square yard. Traffic continues to use the road and all weak and ravelled places are thoroughly patched. The side forms are then carefully laid and checked, as upon rigid side forms largely depends the smoothness of the finished surface. The binder course is then placed over the gravel for the purpose of obtaining thorough consolidation and evening up any irregularities, and covers at the rate of about one ton for seventeen square yards of surface. This binder is thoroughly rolled and compacted, after which an asphaltic concrete is placed to have a compacted thickness of 2 to 2½". The important things to remember in construction of this type are:

1. Check the gravel base to insure at least 6 to 8" compacted depth.
2. Prime the surface and find any unstable areas.
3. Smooth up the base course with a thin binder course and thoroughly roll.
4. Place side forms with utmost care and carefully check smoothness of finished surface.



Street asphalt on concrete, New York City. Surface heater used.

Original Surface Waterbound Macadam

The methods of resurfacing waterbound macadam are very similar to those employed for gravel, except that less work is required to prepare the waterbound macadam to receive a new wearing course. Weak and unstable places show up very quickly in macadam and can readily be patched and the whole surface brought to a true cross section. Resurfacing practice through-



Street asphalt over old macadam in Burlington County, New Jersey.

out the country employs surface treatment, penetration macadam and asphaltic concrete. In state work, penetration macadam is used in large volume, with asphaltic concrete second. In city work, asphaltic concrete and sheet asphalt predominate.

Original Surface Old Brick, Cobble, Old Concrete

These pavements are found in a large mileage, especially in the thickly populated areas of the country. Many of the old brick roads were laid on sand

and gravel foundation, and under the light traffic were quite satisfactory. As the years went by and heavy concentration of loading occurred, many of these pavements became distorted and badly worn. They have, however, become thoroughly stabilized and have a foundation value which can be very economically salvaged by placing asphaltic wearing courses. Returns from a number of city engineers set forth that they preferred old pavements for this purpose, as practically all settlement had occurred, and that the new surfacing did not crack and check as so frequently happened with a new concrete base. Resurfacing of these types fall into two different groups:

1. Sheet asphalt or asphaltic concrete.
2. Surface treatment of thin macadam.

The first method predominates by a large percent, although very excellent results have been obtained in some states and cities with the thin surface treatment. The best practice is as follows:—The old surface is thoroughly cleaned; depression and irregularities are filled with binder until an even and true cross section is obtained. A binder course of at least 1" depth is then placed over the entire surface and thoroughly rolled and checked carefully so as not to vary over $\frac{1}{4}$ " in ten feet. This step is important, because on the care exercised in placing the patching and binder course depends the quality of the finished surface. The wearing course is then placed, being a minimum of $1\frac{1}{2}$ " compacted thickness. Reports selected covering some eight million square yards over old brick and cobble indicate thorough satisfaction with this method of resurfacing at costs varying from \$1.20 to \$2.00 per square yard, depending on the degree of roughness and irregularity of the old pavement.

One city engineer commented quite completely on the economics of re-surfacing of old brick in accordance with the amount of patching required. For his city he estimated the use of 50 lbs. of binder per square yard for this purpose, and 100 lb. per square yard for the binder course.

Old concrete roads have been resurfaced in a very large mileage and the practice has been carried on in all of the older states and cities, and is beginning to be done in some of the newer ones. Reports indicate that in many cases, concrete roads from six to ten years old can be resurfaced to advantage. The best practice is:

1. Careful cleaning of the surface.
2. Careful pouring of the cracks and repair of old broken and shattered areas.
3. Placing a binder course of minimum 1" thickness, and preferably $1\frac{1}{2}$ " thickness, followed by a surface course of sheet asphalt or asphaltic concrete $1\frac{1}{2}$ " thick.

Costs on this work vary from \$1.20 to \$2.00 per square yard, depending on the condition of the old surface. In many cases, widening is carried on at the same time with resurfacing, but this phase of the work is contained in a separate paper and will not be further discussed here.

Several small cities report failure with resurfacing brick and concrete surfaces, and invariably this has occurred because of elimination of the binder course and the attempt to lay a thin asphaltic wearing course without providing for proper adhesion to the base.

The use of surface heaters has been generally successful, many cities reporting the application of asphaltic wearing course without binder where the surface has been previously heated so as to remove all dirt and grease. After thorough heating, the surface is sprayed with a light application of asphalt which provides the necessary adhesion of the wearing course.

Conclusions and Recommendations

Policy

1. That the practice of resurfacing of old pavements, and thus salvaging all previous investment, is eminently sound practice, and that results obtained over a wide variety of materials as foundations have been very successful.

(Continued on page 64)



Laying sheet asphalt on old brick pavement, using paint coat but no binder except in depressions. Anderson, Ind.

English Type of Sewage Distributor on Kentucky Filter

Details of construction and operation; Moonshine still interferes with tank operation.

By Charles H. Kuhn

City Engineer, Fort Thomas, Kentucky

FORT THOMAS, Kentucky, a residential city of 10,000 population in the Cincinnati metropolitan district, is situated on very rugged topography overlooking the Ohio river. The town is divided into several natural drainage areas, most of which flow direct to the Ohio but two flow into the Licking river just above its junction with the Ohio.

The creek from one of the drainage areas joins the Ohio above the intakes of Cincinnati, Newport and Covington waterworks, and treatment of the sewage from this area was imperative. The sewage from the other areas, which naturally drain to the Ohio, empty into that river below the waterworks intakes and are not treated.

Site—The city's garbage and refuse disposal problem and the sewage treatment problem became apparent at about the same time, and a tract of about four acres of rolling land, which includes the junction of two creeks and has a frontage on a main highway into town, was purchased for \$4,000. to serve as a site for plants for solving both problems. It was so situated that the sewage was piped by gravity to about the highest part of the site, and a complete gravity treatment plant was constructed between the sewer inlet and the creek. An incinerator for destroying the garbage and rubbish was constructed near the highway and adjacent to a cottage which existed on the ground when purchased. Both plants were built during the summer of 1929.

Finances—Money for this sewage plant was still available from a \$350,000 bond issue which had been authorized by the electorate in 1924 for sewers and disposal plants, and a bond issue for the incinerator had been authorized in 1928, along with another authorization of \$150,000 for additional sewers.

The Plant

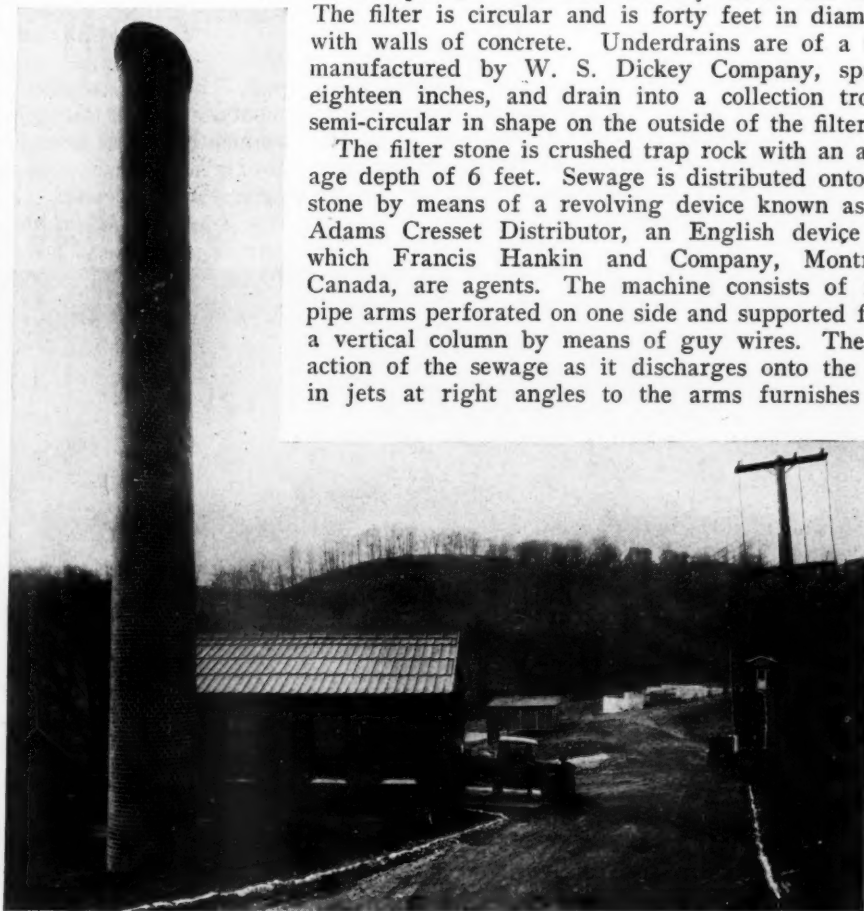
The area which drains to this disposal site comprises about one tenth of the area of the town, and the plant was designed for 60,000 gallons per day; based on the average water consumption for this area, it will treat the flow from 1,000 people.

Because of the size of the plant and the terrain of the site, a tank and filter type plant was thought to be the best adapted to the situation.

The sewage enters the tank direct from the junction manhole of the two outfall sewers, without screening. The tank is an Imhoff tank, hopper bottom type, and, being small, has no provision for reversing the flow. It is 16 feet square and 24 feet deep at the center and was designed for a three-hour retention period and 2,000 cubic feet sludge capacity.

From the Imhoff tank the sewage goes to a dosing tank equipped with an Adams Cresset low-draft automatic siphon, which automatically doses the filter. The filter is circular and is forty feet in diameter, with walls of concrete. Underdrains are of a type manufactured by W. S. Dickey Company, spaced eighteen inches, and drain into a collection trough semi-circular in shape on the outside of the filter.

The filter stone is crushed trap rock with an average depth of 6 feet. Sewage is distributed onto the stone by means of a revolving device known as the Adams Cresset Distributor, an English device for which Francis Hankin and Company, Montreal, Canada, are agents. The machine consists of four pipe arms perforated on one side and supported from a vertical column by means of guy wires. The reaction of the sewage as it discharges onto the bed in jets at right angles to the arms furnishes the



Ft. Thomas incinerator; sewage treatment plant in background.

necessary power and causes the arms to rotate. This type of distributor has been used rather extensively in England, where the machine is manufactured.

From the filter the sewage goes to a secondary settling tank with "V" shaped bottom and valve for cleaning. The clarified effluent from the secondary tank splashes down a steep aerator and sluiceway over the sludge bed and discharges into the creek.

The sludge drying bed is the customary sand-gravel filter with underdrains. Because of its location on a hillside, concrete walls surround the bed.

Chlorine is mixed with the sewage at two points by means of a Wallace & Tiernan solution feed, 10 lb. capacity machine. Chlorine is applied in the inlet before entering the Imhoff tank, and in the secondary tank. It is applied in the ratio of 40% prechlorination and 60% final chlorination.

The chlorinator is located in an eight-foot square brick building just above the Imhoff tank. Chlorine hose lines are laid in fibre duct underground.

The cost of the plant was \$17,350.

The plant is so arranged and constructed that the capacity can be doubled by the addition of another Imhoff tank and filter. The chlorinator, dosing tank and secondary tank need no alterations. The output of the sludge drying bed could be materially increased by shortening the drying period by means of a glass cover, or another bed could be added.

Operation

An effort is being made to operate the plant intelligently and systematically and not turn it over to a laborer with no supervision, as is often done. Implements and appliances have been provided for skimming the two settling tanks, cleaning Imhoff sludge

slot and scraping the flow compartment walls; also a sludge sampler and sounder. A small, practical laboratory is being equipped in the chlorinator building. A sludge testing set has been purchased from the La Motte Chemical Works, Baltimore, Md. The writer expects to acquire additional apparatus to make daily methylene blue, effluent stability, and settleable solids tests. This laboratory will also be used for another plant to be built in 1931.

Chlorine has been found to be very effective in cleaning the growth off the filter stone. This is done when pooling is noticed on the filter, by applying chlorine through a temporary hose line to the dosing tank for a few days. In addition to odor control, chlorine also helps in keeping the effluent channels free of the algae growth.

The operator lives in the cottage adjacent to the incinerator and with a helper cares for both plants, with some assistance in removing sludge.

The sludge produced is stored in piles alongside of the drying bed and is sold to the Country Club for fertilizer for the golf course. The plant is subject to a heavy overload during July, when there are about 1,000 C. M. T. C. boys in training at Fort Thomas. The portion of the government reservation which they occupy is connected to the city's sewer system.

A rather unique situation arose during the summer of 1930. The Imhoff tank gave off a very sour odor, gassing stopped, a heavy growth accumulated on the filter stone, and the effluent was unsatisfactory. Lime was added to the Imhoff tank to counteract this acid condition but did not seem to rectify the trouble. One day while working at the plant it was noted

(Continued on page 72)



Fort Thomas sewage treatment plant. At right, filter tank with English type circular distributor.

Zone Planning of Street Lighting by San Jose

THE city of San Jose, California, is said to have a more comprehensive plan for lighting its streets than any other city of its size in United States. Wm. Popp, city engineer, in conjunction with the City Planning Commission, and with the aid of the lighting engineers of the Westinghouse Electric & Mfg. Co., has laid out a key map of the down-town area and the main arterial boulevards, showing the position of all standards to be erected within the area in the future, so that when any merchant association on any street not now lighted may petition the city to install an ornamental lighting system, it can be

by adding a duplex arm to the present single-light standards and adding one extra lighting unit, thus changing them to the duplex type of standard.

The safety coils in the base of the standards are so arranged that they may easily be changed by one man, and the proper size of safety coil placed therein for handling a duplex lighting standard. As these safety coils carry a Westinghouse disconnecting type of pothead, the above change can be made easily without disturbing the underground system; also this provides for testing the underground cable from standard to standard, or from block to block, without tearing up the streets.

The underground cable is a two-conductor No. 8, rubber covered, lead encased, 5,000 volts. The standards are so wired that alternate ones may be turned off at any hour determined by the manager.



Second Street, looking east from Santa Clara Street, San Jose.

done without loss of time and with a continuity of effect, as a part of a comprehensive project.

The planning commission of San Jose has zoned the city according to its business activities, and the ornamental lighting plans have been made to conform to this zoning; but while the lighting standard and intensity of light differ in the different zones, they all follow a standard design or type.

The five general classes of lighting as laid out in San Jose are—1st, Main business and white-way; 2nd, Secondary business; 3rd, Boulevard lighting; 4th, Residential; and 5th, Utilitarian. The first class consists of white-way type duplex standards, surmounted by a pair of large globes about 20 feet above the sidewalk. Running up the center of the cast iron standards, which are painted a pleasing bronze color, is a 3-inch wrought iron pipe, provided to prevent the globes from crashing to the street in case an automobile should strike the cast iron standard, which would break easily. Atop the branched standard is a pair of 600 candle-power Westinghouse mazda lights. The light standards are spaced from 105 to 117 feet apart. This class of lighting has been installed on First, Second and Santa Clara streets.

It will be possible to take care of future growth without losing any of the present investment for lighting, as it is very easy to extend the white-way lighting into the secondary business districts (which are lighted by a single light mounted on a tall standard)

Exports of Road Machinery

United States manufacturers of road machinery export more than three million dollars worth a year—possibly as much as four million. The indefiniteness of the official figures is due largely to the fact that the government classes all “excavators, including power shovels” together, and, although a considerable number of the excavators are undoubtedly used for highway construction, they are not included in the figures for such machinery.

Omitting excavators, the United States manufacturers exported 1.4 million dollars worth of highway construction and maintenance equipment in 1925, and during the following years 1.7, 2.2, 2.8 and 3.1 million dollars worth. During the first six months of 1930 the figure increased to 2.4 million, a gain of nearly 30 per cent over the corresponding period of 1929; and for the first ten months the figure was 2.97 million as against 2.85 in 1929.

In 1929, of the total value of exported machinery included \$308,835 for road rollers, \$896,622 for road grading and maintaining equipment; the balance is not itemized.

Canada is our best customer, taking 20 to 35 per cent of the total (\$1,202,030 in 1929); and Argentina was next in 1929 and is expected to continue to hold second place, formerly held by Cuba.

Allowable Grades for Highways

This report of the Committee on Allowable Grades gives most fully and concisely the fundamental principles of designing highway grades.

By C. H. Purcell

State Highway Engineer, California, Chairman Committee on Allowable Grades, Am. Road Builders' Assn.

Built into the vehicle of today is enough power and speed to overcome such a wide range of grades, that the allowable in grades is not limited by amount of power but by the economic use of available power and in the safety with which it can be applied efficiently. In every case, the same rule can be applied for selecting the proper grade as for selecting proper alignment—it should be the best that can be secured for a cost consistent with its economic value. The proper grade location design will find a point beyond which further improvement in grade cannot be made without incurring costs or economic disadvantages greater than the grade factor, a point below which a minor grade standard reduces other values to traffic faster than it builds up economies.

To more or less extent, as local conditions present them, the principal features desirable on proper grade design are economy in construction costs, safety and visibility, economy in car operation, and satisfactory drainage. Since alignment also considers the above features as controls in standards, the balanced design is obtained by weighing values for both factors. The location problem is most simple where conditions permit of high standards for both grade and alignment. Invariably, the necessity for decreasing one standard involves necessity for decreasing the other, until, for economy, the critical balanced design is reached. The skilled locator's and designer's sense of proportion, gained from comprehensive knowledge of general values essential on a project, establishes a standard within certain limits. More detailed study on the design entails weighing theoretical economic values, some of which are none too accurately defined by research and for which no engineer has been able as yet to set close rules for the exact guidance of the man in the field. There is probably more indecision at present in grade design than on any other particular factor of design, and this is becoming so apparent that the next few years may accomplish more in arriving at definite conclusions on allowable grades than decades of past experience in highway location.

Level grades are allowable when drainage can be carried from the roadway by the transverse slope of the latter and the roadway section is unaffected by side drainage ditching. An example of such a condition occurs on a raised embankment from which precipitation can pass directly over the shoulders.

When the roadway is through cuts, absence of at least a light gradient necessitates special design of the roadway ditch to carry side drainage. In very light country fitted by level or nearly level grade, the special roadway ditch may be designed on a wide turnpike section. Economy and consideration of adjacent property may dictate uniform depth of side ditches, in which case roadway grade will be controlled by side drainage. Five tenths percent minimum grade for

drainage is usually required; 1.0 percent is preferable. When the length of slight breaks in average level grade is short, the vertical curves reduce the effectiveness of drainage purpose of the roll, no material economy is secured, and the appearance of roadway suffers. Long breaks in slight grades have not these disadvantages. There are cases where short breaks from practically level grade may be forced, as when super-elevation of curvature affects inside ditch drainage in excavation. Here the grade breaks are concealed by curvature.

Extending the use of rolling or undulating grades to cover more appreciable variations in elevation than the foregoing is a very effective method of reducing construction costs in country lending itself to that play in grade design. Experiment upholds the contention that the cost of operation over rolling grades due to grade resistance only is not more than on the average grade between the same elevations, unless the length and rate of any of the component grade breaks reach limits that would show economic disadvantages if each break be considered as an individual proposition. For example: On a rolling grade composed of 3 per cent undulations, the amount of fuel used on ascents is recovered on the descents and no braking is necessary and uniform speeds can be maintained. If, however, an undulation included a long stretch of 7 percent grade, that stretch, although it might equalize fuel consumption over all, would, for certain vehicles, limit uniform speed, overtax high gear operation, require braking on descent, and increase driving hazards. These disadvantages would be assigned to the individual grade section, and only in that respect affect the value of the series of undulations.

The car operation cost on undulations must consider all classes of vehicles, light and heavy. Herein lies one reason for limiting the length and rate of an undulation. It does not require that rate of grades be limited to the maximum at which trucks would operate as economically as on the substitute average grade, but the economic loss for trucking element must be brought into the equation.

That an undulating grade can be equated to equality with a uniform grade, for car operation cost, does not necessarily permit its adoption on an equal basis. With construction cost equal, the uniform grade would be preferred for other reasons—vertical curvature, the relation of grade to curvature, if the latter is involved, uniformity in speed, etc.

The critical grades that affect fuel consumption start from those gradients that influence efficiency in high gear. The length of grade and the class of vehicle operating thereon set the grade rate below which fuel consumption is not appreciably lowered on normal speeds. On grade rates higher than this, relative fuel consumption has been difficult to evaluate

for practical application. The economical grade for up-going cars will be different than for descending vehicles. On the latter, use of brakes and safety of speed are prime factors. The length of grade assumes greater importance in relation to economy of operation as grade rates increase.

Under normal conditions, high gear will efficiently carry heavy trucks up maximum sustained grades of about 3 percent. Automobiles will similarly operate up about 7 percent sustained maximum grade. Reduction of sustained grades less than 3 percent is seldom justified by fuel economies on the composite vehicle. Between 3 percent and 7 percent, heavy trucks suffer losses in lower gears and lost time which the lighter automobiles do not incur. For the automobile only, reduction in grade below maximum 7 percent is justified by other considerations more than by fuel consumption. Grades in excess of 7 percent become disadvantageous to all vehicles for so many other reasons than fuel consumption that 7 percent appears to be a conservative allowable maximum for highway practice. Six percent is a preferable maximum for general use and for sustained grades.

Maintenance of uniform safe speed is a convenient measure of the desirable grade, supplying reasons for reducing the maximum below that allowable on a basis of fuel consumption only. This leads to considering 5 percent grade a desirable maximum on first-class roads, particularly when curvature is not excellent.

It eliminates many of the grade disadvantages noted in the following.

Loss of time through speed reduction on steep grades is in many instances an item of operating expense for the commercial vehicle, although it is too often over-capitalized. For other vehicles it is a minor factor. When, at a sacrifice in distance, grade is lowered below the maximum at which high gear work is efficient, the distance adds more to loss of time than grade reduction saves.

Where composite vehicles ply steep grades, the slow-moving vehicle may retard the fast, as when the latter tries to pass. This may lower the speed necessary for efficient operation in high gear, requires acceleration after slowing up on ascending grades, braking on descending grades. On heavily traveled roads it multiplies the points of congestion, lowers the apparent capacity of width, increases hazards. This hazard in passing increases when curvature limits the sight distance.

When altitude reduces power, a reduction in normal allowable maximum grade must be made if high gear efficiency is to be maintained. Only ascending vehicles, or half of the total traffic volume, enter into capitalized values on this power consideration. Road-bed conditions due to snow, ice, sleet or fog will decrease effective traction and braking. Under above conditions 5 percent maximum is a standard comparable to 7 percent maximum under ordinary conditions.

Vertical curvature is an element in grade design as essential for safety as is horizontal curvature on alignment design. It should provide sight distance or visibility sufficient to permit approaching vehicles to come to a stop, in emergency, before meeting. The summit vertical creates the greater hazard. Six hundred-foot sight distance is a reasonable minimum, and 800-foot sight distance is desirable on major routes. Since roadway width is proportionate to traffic, and vertical

curvature is a safety device common to all classes of roads, short vertical sight distance cannot be considered of less importance on minor roads than on primary routes. Sag vertical curves should not be so sharp as to cut the length of illuminated roadway at night to a short distance. Headlight glare on summit verticals is a source of danger and gives one reason for eliminating or improving those vertical curves as much as possible. A vertical curve may have a generous sight distance designed, but unless that fact is evidenced by other vehicles being in sight thereon, the conservative driver often cannot judge length of visibility and would not safely enter the opposing lane, to pass another car, for instance. This condition will operate to reduce roadway capacity and safety during heavy traffic and is a consideration against vertical curvature and breaks in grades that require them, including rolling grades.

Horizontal curves should overlap vertical curves when they coincide. By this means, approach of the horizontal change will become apparent to the driver before it is obscured by the vertical curve.

Drainage usually dictates that vertical curves should not reach the sag in cuts. Seldom will conditions be found where the vertical should dip on an inside horizontal curve. Whenever horizontal curvature is involved, the grade should be as uniform and unbroken as conditions will permit. Long, open curves present a better appearance if on unbroken grade, and traffic follows traffic lanes more carefully than when adverse grade is before them. A sharp curve at the end of a steep grade is dangerous.

On long sustained grades of allowable maximum for tangent, the grade should be compensated for curvature. California standard compensation, in percent of grade, equals 125 divided by radius. It is applied to grades of 6 percent to 7 percent. Additional allowance should be made when the current alignment is subject to radical improvement that will shorten distance.

On long, heavy grades it is preferable to use the maximum at the foot of the incline and lighter grades near the summit, or to compensate on heavier curvature, than to use a sustained uniform grade that is but slightly below the maximum.

Superelevation of curvature will increase the maximum grade on the lanes of travel. This increase over center line maximum may influence allowable maximum on center line or the standard of curvature. Since superelevation is based on speed and curvature, it is often consistent to reduce standard superelevation over sharp curvature on the assumption that speed will be controlled by evidence of curvature. The maximum grades at transition of superelevation will in this case be lowered and a more uniform grade design be made possible.

Curvature that limits speed and visibility calls for reduction in allowable maximum grades for matters of safety, future curvature improvement and for any reduction in efficient motor power caused by slowing movement on the highway. Controls, in location and construction costs, however, usually dictate limits to the excellence of grade and curvature standards. Fuel consumption on grades becomes of less importance than safety, convenience, distance, etc. When deciding the extent of the necessary disadvantages which

(Continued on page 56)

Digestion of Raw Sludge Seeded with Ripe Sludge Filtrate

By C. E. Keefer, Engineer of Sewage Disposal, and Herman Kratz, Junior
Chemist, Bureau of Sewers, Baltimore, Md.

MUCH has been learned during the past few years regarding the digestion of raw sludge. Raw sludge in a number of cases has been seeded with a definite quantity of ripe material, and its rate of digestion observed under various environmental conditions. It is an accepted theory that sludge digestion is produced by bacteria and their enzymes. As these bacteria and enzymes also are present in the liquid in which the ripe solids are suspended, it was considered of sufficient interest to see how quickly fresh sludge would digest when seeded with filtrates obtained from sludges in various stages of decomposition, and also to compare the rates of digestion of these mixtures with the same fresh material seeded with sludge proper.

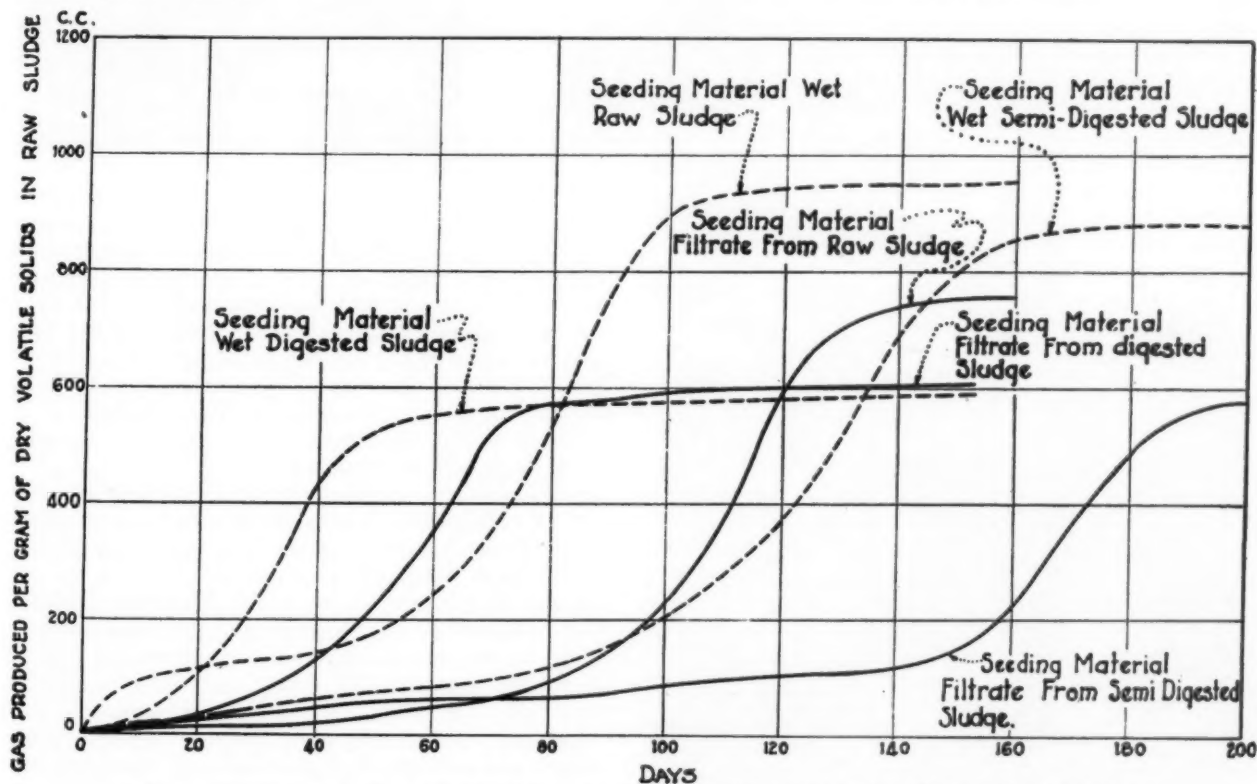
In order to make such a comparison, raw sludge from the preliminary settling tanks at the Baltimore sewage works was placed in a number of bottles, which were divided into two groups. The materials in the first group were seeded with the filtrates from raw, semi-digested and digested sludge, and those in the second group with the same sludges from which no liquid had been removed. All of the work was done in duplicate so that a careful check could be made of the results.

The sludges were mixed in the ratio of two parts by weight of raw sludge to one part of the seeding material. All of the sludges were incubated at $28^{\circ}\pm 1^{\circ}\text{C}$. During the experiment the pH values of the mixtures were kept at 6.9, or slightly higher, by the frequent addition of lime.

Results

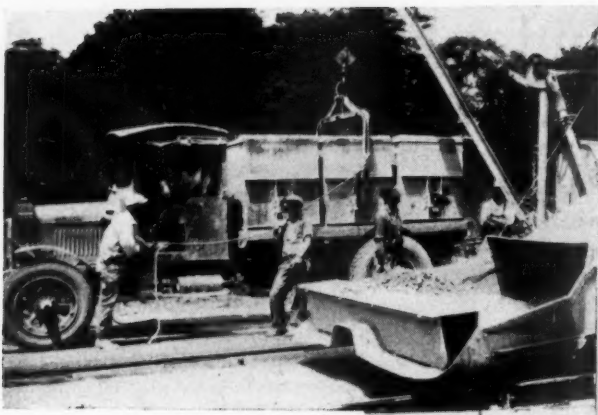
The rapidity and the extent of digestion was judged by the total quantity of gas evolved. In every instance, as indicated, digestion was considerably more rapid in the materials seeded with wet sludge as compared with those seeded with sludge filtrate. Furthermore, the former materials were digested from 10 to 20 days sooner. This condition was true regardless of whether the seeding material was ripe, semi-digested or raw sludge. The quantities of gas produced per gram of dry volatile solids in the raw sludge, as indicated by the curves, are shown as being above normal in the two cases where the seeding material was semi-digested and raw sludge. Strictly speaking, however, this was not the case, as some of the gas was evolved from the raw or partially digested solids in the seeding material.

(Continued on page 72)



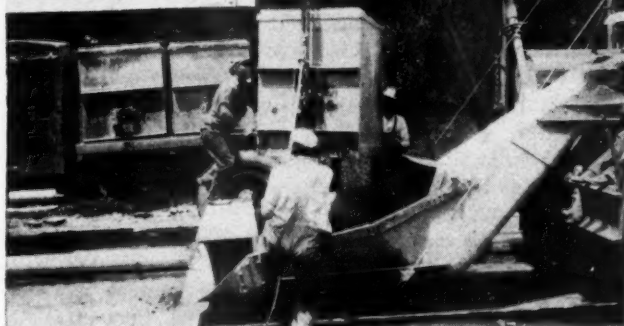
Relative quantities of total gas produced from fresh sludge seeded with sludge filtrate and with sludge.

Ripe, semi-digested and raw sludges and their filtrates were used for seeding. All materials were kept at a pH value of 6.9 or slightly higher and incubated at 28 Deg. C.

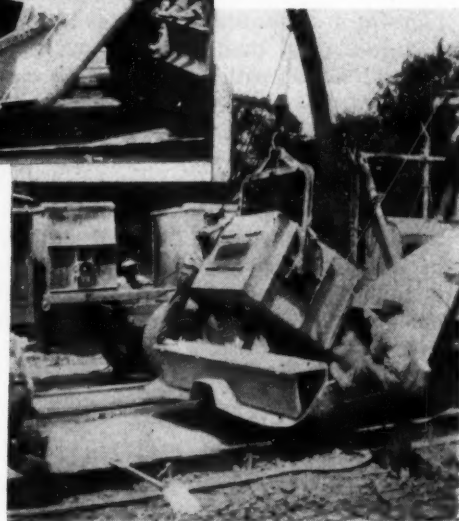


Above—Ready to unload batch box from truck.

At right—Method of unloading batch boxes from truck. Swing crane takes box from truck to position above skip.



Below—Dumping batch box into skip. Spring catch released, allows eccentrically balanced box to invert itself under slight pressure on its top by dumper.



ON September 26, 1929, bids were opened for the construction of a section of Route 615, Spur, Lackawanna county, Pennsylvania, between the villages of Finch Hill and Montdale.

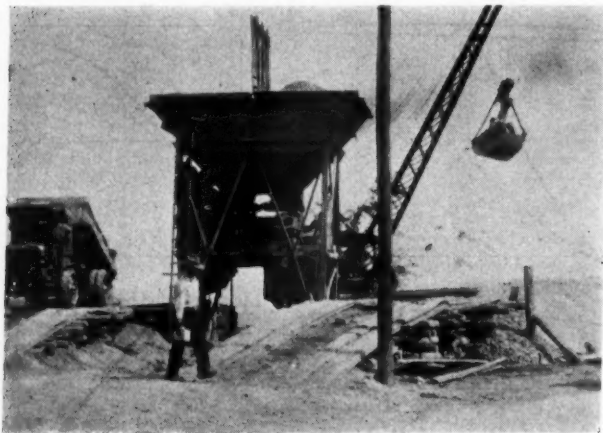
This project lies in the northwest section of Lackawanna county and has historical significance, as it is a part of the old north and south turnpike, which in the early days of this section of the State was greatly used by the pioneers coming into this region. It connected with the Belmont and Easton turnpike at Dundaff on the east and fed the Philadelphia and Great Bend turnpike on the west. Today it traverses a rich agricultural section and also leads to several lakes that are popular as summer resorts.

John Booth, Incorporated, Carbondale, Pennsylvania, was the low bidder, and the contract was awarded to that firm on October 7, 1929. Work got under way on October 18, and was carried on through the winter, with the excavation being completed on

June 2, 1930. On this date the paving operation started and was completed in its entirety on August 23, 1930. The contractor made unusual progress in both the excavating and paving operations, completing the work in 119 working days, although 145 days had been allowed in the contract. Exceptionally fast time was made in placing the pavement, it being completed in 45 working days. The project was 29,326 feet in length, and the average daily production of pavement was 1304 square yards, with a maximum production of 2530 square yards.

The main office of the contractor is located in the city of Carbondale, Lackawanna county, at a point about one-half mile from his material yard, located on the O. & W. Railroad. From this yard to the beginning of the project, at which point the batching plant was erected, is approximately five and one-half miles, of which two miles have gradients of 6% or more. The road for the entire distance, however, is improved with either concrete or macadam.

In the Carbondale yard, cars of cement, sand, gravel and calcium were received and unloaded, the cement and calcium being trucked to a warehouse adjoining the yard, and the sand and gravel directly to the batcher plant at the beginning of the project.



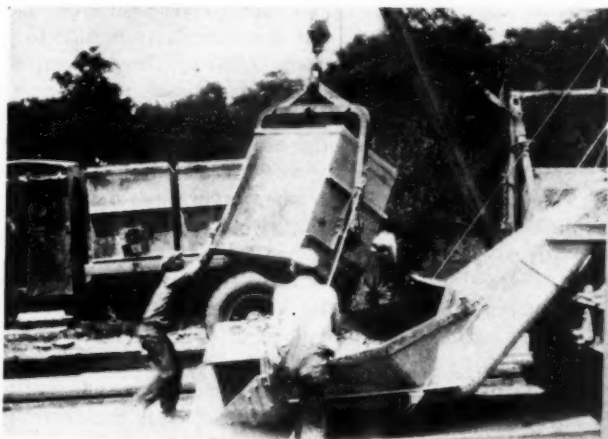
Clamshell hoist loading gravel from stock pile to bin. Also truck unloading sand to stock pile.

Methods and equipment by means of which John Booth laid five and a half miles of pavement in eighty percent of the contract time.

By S. P. Longstreet

Division Engineer, Pennsylvania Dept. of Highways

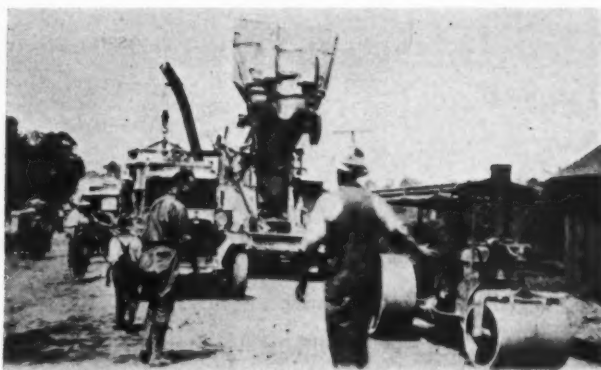
The work of unloading the sand and gravel cars was facilitated through the use of a bucket conveyor which was constructed beneath the siding. This conveyor emptied into a steel bin having a capacity of 50 to 60 tons. The trucks containing sand and gravel, upon their arrival at the batcher plant, backed upon elevated wooden platforms situated on both sides of a Blaw-Knox hopper bin. The platforms were elevated about five or six feet above the natural contour of the ground, which permitted the material to be easily unloaded. The sand was dumped on one side of the bin while the gravel was placed on the other. Adjacent to the bin was a clam shell hoist of one cubic yard capacity. This clam formed the stock piles by moving



the material from the unloading pits and placing it in stock. In addition to forming stock piles, the clam was used to keep the sand and gravel compartments of the bin filled. It required about 1½ minutes to place a clam full of gravel in the bin, sand two clamsful per minute; to transport gravel from dumping pit to stock pile about 2½ bucketsful per minute, and about three bucketsful of sand per minute. The clam shell was operated by an engineer, fireman and pitman.

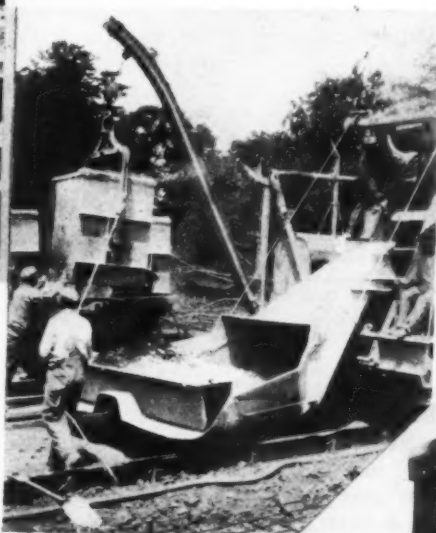
The materials were transported to the mixer from the batcher plant in steel batch boxes placed on flat-bottom trucks. The batch boxes were similar to the ones used on industrial systems. The box was divided into three parts, one each for gravel, sand, and cement, with the cement compartment having a flanged lid. This compartment, incidentally, had ample room for six bags of cement. To prevent the boxes from sliding off the trucks, a 4 x 6 was placed around the outside edge of the body.

Close by the batcher plant a cement house was built. At the rear of the house, centrally located, was a door and platform, before which the incoming trucks stopped and unloaded cement, being assisted by a gasoline-driven conveyor belt loader. Two men usually



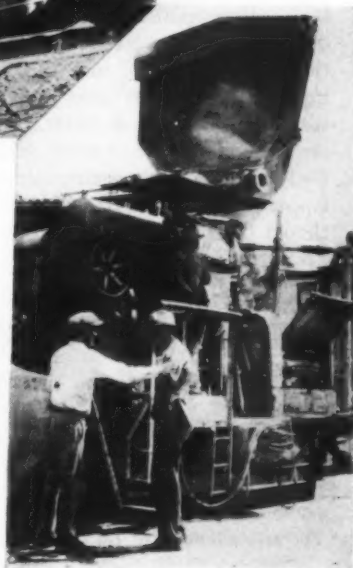
Ahead of the mixer. Mixer foreman asking fine grade foreman to get pup roller out of the way before mixer runs over it.

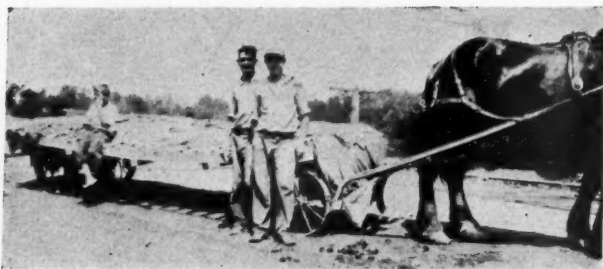
unloaded each truck. In the inside of the house, the force consisted of two unloaders, three carriers and three laborers to pile. This force of men could place a six-bag batch upon the trucks in 25 seconds, remove 20 bags per minute from an incoming truck, and could stack 30 bags per minute. The cement was placed in the batch boxes on the return of the truck from the mixer and before it was loaded with sand and gravel. The trucks then turned around and backed under the bin. Thirteen trucks were used in hauling batches, 7 carrying two-batch boxes and 6 carrying 3-batch boxes.



Below — Skip raised to dump material into mixer. One of the spaders holding a serious conversation with mixer inspector Mahn.

At left top — Righting the batch box. A quick pull back and downward by dumper snaps box in upright position again. Above—Replacing batch box upon truck by swing crane after box has been emptied.





The burlap wagon.

This permitted, even with a haul of six miles, of no delay, there always being a truck or two waiting at the mixer to be unloaded.

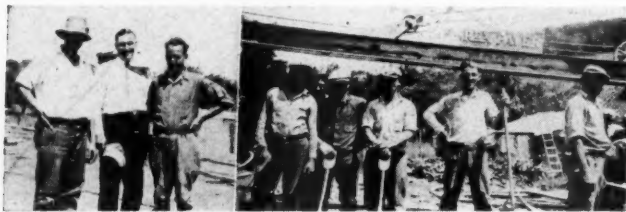
The mixer was equipped with a swing crane similar to a davit on a steamship. This required a separate operator, who was stationed on the far side of the mixer. The hoisting apparatus was geared to the same mechanism that operated the mixer. The hoisting cable on the crane was equipped with an inverted "U" shape clasp that operated similar to a pair of ice tongs with a spring at the top that spread the jaws. At the gripping end of these jaws were hub shaped lugs that fitted in slots on either side of the batch box. These slots had a sliding bar operated by a spring lever from above that locked the lugs and prevented them from tipping.

A truck, on arriving at the mixer, stopped at a point on the side of the mixer adjacent to the skip, when the crane and clasp would swing over a batch



Cleft machine in operation. Cutting joints.

box, whereupon two men placed the clasp in position on the box. The batch box was then swung into position directly above the skip, the clasp released, allowing the box to tip, and empty into the skip. The box was so constructed that the point of balance was slightly above the place where the clasp took hold. Only a slight pressure, therefore, was necessary in tipping the box. After being emptied, a quick forward thrust caused the box to return to its upright position and a snap catch locked it in place. Four men were



At left—Contractor Edwin Booth with his superintendent and mixer foreman. At right—The pitmen.

required to empty the batch boxes, one operating the crane and three assistants taking care of emptying the boxes and returning them to the truck. The entire operation required one minute and eighteen seconds. On a haul of approximately ten miles, trucks were making round trips in forty minutes.

The mixer used on this project was a 27-E Rex paver, with caterpillar traction. It was equipped with an automatic calcium chloride device. The mixer gang comprised a foreman and nine laborers. Four laborers were used to spread the concrete after it had been dumped on the subgrade, two were used in spading along the forms, one placed the reinforcing mesh and steel, while the last two were used ahead of the finishing machine, keeping the concrete in such a position that it was easily and uniformly worked. The finishing machine was operated by one man. Three finishers with three helpers were used in finishing the pavement. The finishers not only finished the surface, joints, etc., but also operated a cleft machine for placing the transverse joints. Four men were used in placing the burlap and sprinkling the pavement. To expedite matters, a horse and wagon were used to haul burlap, operating on the shoulder. The wagon was constructed with small, wide-rimmed wire wheels, with a platform long enough to accommodate a full length of burlap. It was likewise low enough to permit of easily handling the burlap. The burlap, after being placed on the wagon, was thoroughly saturated.

The reason for the efficiency of this paving operation can be placed on the methods adopted by the contractor in both loading and unloading materials, the smoothness with which the paver operated, and the labor-saving devices that were used in the various operations.

Regardless of its location, the pavement was constructed in half width. This permitted of the batch trucks operating on one half of the subgrade, and also speeded up the movement of the trucks, as they utilized the pavement after it was cured sufficiently to drive upon. As the subgrade between the forms was not disturbed by trucks, the overrun in cement was kept down to a minimum. The contractor used a mechanical subgrader and two screed boards, calling them "Amos and Andy," or in other words, "Check and Double Check." One operated ahead of the mixer while the other was behind the mixer.

Water Department Used as a Source of Revenue

The statement of the Quincy, Ill., water works commission for the year ending Sept. 30, 1930, shows a total operating revenue of \$279,372 and operating expense of \$103,082, leaving a net operating income of \$176,290. But—\$158,091 of the operating revenue might be classed as a bad debt, leaving only about \$18,000 to be transferred to surplus. This bad debt was money charged to the city for fire hydrant service, repairing fire hydrant damaged by city's tractor, and water furnished to the city, and \$80,000 cash which the city council ordered the water commission to turn over to the city treasury.

During the previous year the council took \$40,000 of the water works funds and failed to pay for \$78,011 of services received.

Water Supply and Sewage Disposal in Cairo, Egypt*

H. Heukelekian

*Research bacteriologist, Dept. of Sewage Research, New Jersey
Agricultural Experiment Station.*

PERHAPS nowhere else is there a better example of the vital importance of water to the very existence of a country than in Egypt. Egypt is a desert but for the Nile, and all the past and present civilizations have been limited to its banks. What the absence of water means can best be realized by the contrast between a strip of land along the banks of the Nile and the rest of the country. The Nile is the very basis of the existence of the country. The flow of the Nile therefore is carefully regulated by the Asswan dam.

Egypt has a total population of 14,000,000, mainly rural. With the exception of a few large cities like Cairo, Alexandria, Suez, Port Said and Tanta, the people live in small, drab mud-house villages under the heating rays of the sun. The fine-grade cotton which is raised by irrigation is the chief livelihood of the people and the main source of wealth of the country. The average peasant and laborer classes are extremely poor and live under an utterly unsanitary condition. High temperatures combined with poor sanitary conditions make the spread of epidemics a menace in spite of the vigilance of the authorities. In conjunction with fly breeding and improper food handling, the water is the chief agent responsible for the spread of epidemics.

Water Supplies. There are at present in the entire country 28 water works filtering surface waters and 22 wells which supply water without any treatment. The water purification plants are supplied with chlorinators, which are used only in case of an epidemic; the only water supply using chlorine regularly being at Cairo. Water consumption is low, averaging 30 to 35 gallons per capita per day.

The laboratory section of the Department of Public Health controls the water supplies. The laboratories, which are situated in Cairo, are well equipped and a number of well trained chemists and bacteriologists are employed. Weekly samples from the different purification plants are sent by the local medical officers to the central laboratories in Cairo. In chlorinated water, it is the regulation that lactose fermenters should be absent in 50 c.c., while in non-chlorinated waters, which are more predominant, the allowable number of lactose fermenters in 10 per 10 c.c. of the water.

The construction of the water purification plants is centralized in the Central Municipalities and Local Commissions section, in order to safeguard the interests of the individual municipalities.

The Cairo Water Supply

The water treatment plant of Cairo, which has a population of 800,000, is at Rod el Farag and is very

up-to-date. The water is obtained from the river Nile. The amount of suspended matter in the river varies greatly during the year, depending on the flow in the river. From January to August, when the flow is low, the suspended matter is below 150 p.p.m. In August with flood waters the suspended matter jumps to 1500 p.p.m. and then drops gradually down to the former level in December. The average *B. coli* count of the raw water is 25 per 10 c.c.

The water is pumped by two 450 h.p. and two 250 h.p. motors at the rate of 26 m.g.d. Alum is added to the intake pipe at the rate of 2 to 4.5 grains per gallon. Fifty per cent of the water goes through a preliminary sedimentation tank provided with a Dorr clarifier, which is said to remove nearly 80 per cent of the suspended solids in four hours of detention period. The effluent from this tank flows into four secondary tanks, where an additional 7-hour detention period effects a further ten per cent reduction of suspended solids. The other fifty per cent of the flow goes directly into four other secondary tanks, which effect a sixty per cent sedimentation of suspended solids.

There are 32 rapid sand filters of the Jewell type and 12 of Paterson type. The filtration is at the rate of 35,000 gallons per filter per hour. The Jewell filters are 20 ft. in diameter and 4.5 ft. deep and are provided with rakers to stir up the fine sand. The wash water consumption is ten per cent of the total flow and the filters are in use 6 to 24 hours. The Paterson filters are washed with compressed air and water for two minutes, after which the water is wasted for twenty minutes. The regulation is by an automatic control float.

The filtered water is chlorinated at the rate of 0.35 p.p.m. of chlorine, with no residual at the end of two hours' contact. There are four chlorinators, of Paterson type.

The water is analyzed every day from the tap, and once a week the bacteriologist from the laboratory of Public Health takes samples of raw water, coagulated water, filtered water and chlorinated water at the plant.

The bacteriological tests consist of:

1. Endo agar count at 45°C. for 24 hours.
2. Nutrient agar count at 37°C. for 24 hours.
3. Lactose fermenters by McConkey's medium.

Seventy per cent of the tests in a year have shown *B. coli* to be absent in 100 c.c. portions and ninety to ninety-five per cent absent in 50 c.c. portions.

Under the intensive sunshine and with high temperatures prevalent, algae growth in the river is abundant during low flow, clogging the filters and giving the water an undesirable taste. Treatment with copper sulfate has been tried without material benefit and has been abandoned.

*Journal Series paper of the New Jersey Agricultural Experiment Station, New Brunswick, N. J., Dept. of Sewage Research.

Sewage Disposal

The disposal of sewage in Egypt is mostly by sewage farming, with or without some preliminary treatment. The abundance of sandy land and the shortage of water makes this type of disposal practicable. The sewage is strong domestic sewage, due to low water consumption (30 g. per capita). The sewage is usually pumped to these farms, which are at some distance from the cities (ten to twenty miles). High temperatures, long sewers and alkaline waters make conditions ideal for hydrogen sulfide production. Though the farm may be at some distance from the city, there is usually a village around the farms inhabited by the laborers. The more objectionable phase of hydrogen sulfide production is the corrosion of sewer pipes and the deterioration of tile and cement lining. Chlorine would prevent and remedy these troubles. There are five or six such disposal plants in the bigger cities of the country, such as Cairo, Suez, Port Said, Tanta and Mensura.

The Main Drainage Department serves as consultant to municipalities for the construction of their sewage disposal plants.

The *Cairo Sewage Farm* is located in Gebel al Asfar, fifteen to twenty miles from Cairo. The sewage is pumped from two pumping stations and is seven hours old and in very septic condition when it reaches the farm. The sewage is treated in six Travis tanks with a calculated detention period of two hours. A sixty per cent removal of suspended solids is brought about in these tanks. The sludge from the hoppers is discharged by gravity once in six days onto small drying beds. As the farm is in the desert, there is an unlimited supply of sand. The sludge is distributed four inches deep and is dried in four days. The sludge, which has a nitrogen content of 2.4 per cent, is sold to the farmers for \$1.00 per cubic yard and yields \$15,000 a year.

The effluent from the Travis tank is passed to the farm for irrigation purposes. The farm embraces 1,400 acres, and the crops grown are mainly citrus fruits, and some maize, beans, barley and corn. This is a co-operative project of the Ministry of Public Works, which takes charge of the engineering aspects, and the Ministry of Agriculture, which controls the farming. There is a well organized village of 800 people composed of the laborers on the farm, who are paid only 25 to 30 cents a day. The net income from the farm itself is \$60,000 a year.

About one per cent of the total flow is filtered over stone filters 6.5 ft. in depth. The sewage is distributed by mechanical distributors, which travel over the area of the bed in the longitudinal direction.

Some of the chemical results are given below:

	Suspended matter ppm.	Organic matter in suspension ppm.	Alkalinity ppm.	O ₂ absorbed ppm.	B. O. D. ppm.	NH ₃ ppm.	NO ₂ ppm.	NO ₃ ppm.
Sewage	472	284	470	140	420	56	0	0
Tank effl.	131	73	—	90	240	—	—	—
Filter eff.	80	48	260	30	60	4.9	.1	7.5

Agar plate counts (37°C. for 24 hrs.) gave 50,000 per c.c. for crude sewage, 20,000 for tank effluent, and 6,000 for filter effluent.

To Utilize Los Angeles' Waste Water

Officials of the Chamber of Commerce of Los Angeles, Calif., are urging upon the mayor, city council and department of water and power, that the sewage and other waste water of the city be clarified and put to agricultural and industrial use instead of being discharged into the ocean.

The ideas are expressed as follows:

"1. That sewage and waste waters are an asset of great and increasing value to the community and that all governmental agencies be urged to give diligent attention to the development and execution of plans for the rectification of such waters and the application of the effluent to beneficial use for agricultural and industrial purposes.

"2. In conclusion with the foregoing declaration:

"(a) It should be recognized that the sewage and waste waters of the city of Los Angeles now being discharged into the ocean are an asset of inestimable value;

"(b) The city should perfect title to this asset by applying this sewage and waste water to beneficial use.

"(c) To that end the city should proceed at once and with all possible diligence to rectify this sewage and waste water, and devote the effluent to agricultural and industrial use."

Water Tower Named for Allen Hazen

The new water tower of the Des Moines, Iowa, water works will be called the "Allen Hazen Tower" in honor of the late Allen Hazen, who was consulting engineer for the improvement. The tower will have a height of 100 feet and a diameter of 130 feet.

Popular Regulations Are Enforceable

In his message to the Council of December 6th, Hume K. Nowlan, city manager of Hinton, W. Va., said: "From the standpoint of enforcement we have been far luckier in initial policy than the police have been efficient. Traffic control lights have been installed only where there has been a popular demand, and not promiscuously for the purpose of giving a metropolitan air to the arteries. Angle parking stalls and parallel zones have been laid off in relation to street widths and lane volume, rather than from any fixed rule. Prohibiting parking on one side of busy blocks has been more popular and effective than limiting standing time. Where time limits have been set they were determined more by the occasion than from dictatorial policy. No private rights or special privileges have been sold or granted anywhere. Consequently we have had no major traffic problem to solve because our flexible ordinance has permitted regulation before a serious snarl developed."

Paying Taxes on the Instalment Plan

A recent number of "Citizens' Business," published by the Philadelphia Bureau of Municipal Research, urges allowing payment of taxes by weekly or monthly installments. They argue that, with delinquencies high and increasing, with uncertain revenues disrupting budget methods, the almost universal plan of installment buying should be applied to tax payments.

THE EDITOR'S PAGE

If You Don't See What You Want, Ask for It

During the past month about one hundred of the subscribers to PUBLIC WORKS have written in response to our request that they tell how we can make our reading pages more helpful and interesting to them. It has naturally given us a feeling of pleasure and satisfaction to read the unanimous approval of the magazine as a whole; but we especially appreciated those letters which, in addition, suggested topics which the writers would like to see discussed. And we will endeavor to obtain and print information on all of these topics during the next few months.

Some of our responses to these requests appear in this issue. One city engineer asked for information about resurfacing worn-out brick and granite block pavements, and a partial answer is given on page 21 of this issue, while construction details of a specific improvement will be given in another—probably the April issue. Other subjects suggested relating to street work include oiling streets and traffic regulations.

Those interested especially in sewerage request information concerning disposal of trade wastes, inspecting sewer connections, and standard symbols for sewer maps. Water works men express interest in electric thawing of lead and copper pipe, and office management of water and other utilities. One city is especially interested in refuse collection and disposal, and will find three articles on the subject in this issue.

Other subjects concerning which information is wanted are: House numbering systems; gasoline stations; municipal records, and model public works ordinances.

One general comment repeated by several was a request that we pay even more attention to every-day problems and less to the big projects to which some other engineering papers devote so much space; and that we emphasize the practical rather than the technical features.

If there is some other subject *you* would like to have discussed, let us know about it. Our aim is to give *you* what you want, if we can learn what that is.

Help Wanted

And here we want the help of every reader of PUBLIC WORKS. Practical features of the every-day problems of the engineer or contractor on jobs of ordinary magnitude—most of you are in touch with these right along. Or you have had interesting experience with, or developed especially successful methods of handling, paving, water works, sewerage, refuse disposal, or other lines of city, highway or other public works in the field or in the office. These are just the things we want to publish, because you and others have said they are what *you want*. And the only way we can get them is for you to tell them. Never mind if it takes only a page, or even a paragraph, to tell—the shorter it is, so long as all the pertinent facts are given, the better. Don't feel that you must write

an "article." Just tell the facts in your own way, with a blue-print or pencil sketch or photograph to help, if they are appropriate and available. In nine cases out of ten a short item of this kind will be more generally read and more favorably received by others in your profession than would a formal article of several times the length.

In Resurfacing, Save the Bases

Every improved road surface consists of three parts—a wearing surface, the immediate support of that surface (the base course, if there is one), and the subgrade. Macadam, gravel, sand-clay and similar surfacings are considered by many to be surface courses, and to have no base course. This, it seems to us, is an incorrect view and one which has led to uneconomical use or waste of highway funds. Such surfacings are *all* base, except for a depth of a fraction of an inch which receives abrasive and other effects of traffic and offers a smooth and otherwise favorable surface to it, and in some cases provide a waterproof covering to the base and subgrade.

The function of the base is to distribute the load over the subgrade, and its ability to do so varies with its depth. The purpose of the wearing surface is performed by the particles which lie in the actual surface, and its depth is of no importance except as it is necessary for giving permanence to the surface; or, in some classes of pavement, as it serves as a cushion between a rigid base and the wheels of traffic. In the surfacings here referred to, the wearing surface is integral with the base.

In most cases the base continues to move slightly subsequent to construction and to compact under traffic; also to readjust itself as the subgrade compacts, where this occurs; and this necessitates repeated reforming and conditioning of the surface. Ultimately, when subgrade and base have reached a stable condition, the surface also can be given a more or less permanent form, generally referred to as "resurfacing." But on these types of road the surface is generally not a separate entity (the "carpet coat" has not often proved satisfactory) but is a special treatment of the top surface of the base to render it smooth, dustless, firm and, where desirable, water-proof. There is little if any advantage in carrying this top treatment deeper than is necessary to effect these aims; while there is a decided disadvantage in disturbing more than is necessary of the old material, which is all compacted base whose effectiveness varies as the square of its depth, and with a value largely given it by months or years of traffic, which value it would be difficult to reestablish quickly.

The point we wish to make is that these macadam and gravel roads are not surface courses but are bases, and that "resurfacing" should not be considered to involve or warrant disturbing them to a greater depth than is necessary to give their top surfaces the desired characteristics.

Economic Development of Secondary Highways

Is the logical and necessary procedure now to meet most fully the traffic requirements of the country and secure the greatest benefit from the funds available.

A SECONDARY road Mr. Gray defines as any road carrying less than 800 vehicles a day, and says that "well over 85% of the total mileage of highways in the United States are included in this class."

In 1929 the amount available for rural highways reached \$1,500,000,000; and for 1931, as a result of extraordinary appropriations to relieve unemployment, this total will be \$1,650,000,000. Many are making plans for the future on the theory that traffic will increase indefinitely at rates similar to those of the past ten years, but Mr. Gray asserts that such increase will not occur. "From graphs plotted for registration, expenditures and income, it is clearly shown that the peaks are being reached, and that except for the hysteria of 1928-1929, they would have been reached even earlier. Assuming that the United States grows in population for the next ten years as it did in the past ten (which it will not do), by 1940 it will be 140,000,000. At the rate of one car to 4.5 persons, this would make a total of 31,000,000 cars, requiring an annual increase of 400,000. The years 1930-1931 do not show this rate of increase, so that subsequent years will have to show even higher averages to produce this total. In other words, the country is finally reaching the saturation point in motor vehicles, and further additions will be of smaller amount."

Billions have been spent on our highways during the last few years, and with what result? "There are over three million miles of roads in the United States, of which 306,000 miles are in the state system, or the so-called 'primary group.' In this state group, high types of pavement, which include bituminous macadam, sheet asphalt, asphaltic concrete, brick, and concrete, totaled 68,000 miles as of January, 1929. Stone, gravel, sand-clay, etc., totaled 125,000 miles; graded and drained roadbeds 32,000 miles; while 81,000 miles were yet unimproved. On the county and district roads, or the so-called 'secondary system,' there were 34,000 miles of high types, 398,000 miles of stone, gravel and sand-clay, and 2,276,000 miles unimproved. With subsequent additions in 1929 and 1930, there are today on both systems, 120,000 miles high type, 600,000 miles of stone, gravel, and sand-clay surfaces, 50,000 miles graded, while the balance of 2,300,000 miles is unimproved. To accomplish this result, there has been spent over twelve billion dollars."

There are five times as many miles of stone, gravel and sand-clay roads as of the high-cost types, and they form "the real backbone of the system, and will

continue to be so, because there simply is not sufficient money to replace them with so-called high types."

Mr. Thomas McDonald, chief of the Bureau of Public Roads, is quoted as saying that what was required more than additional funds was more intelligent and better use of the ones now available; and Mr. Gray states his belief that such intelligent use is developing by the increasing construction of treated gravel, stone, sand-clay and other low-cost roads.

From these considerations he believes that the following fundamentals are well established:

1. A highway system which does not serve all of an area, and everyone in the area, all the year around, is not functioning completely, and the neglected areas and persons are justified in making a loud and mighty protest.

2. While ten years ago, the building of a new improved surface usually was followed by marked increase in traffic, such is not always the case today. In fact, there is frequently a temporary decrease, for, with the construction of parallel routes, there follows greater dispersion of traffic. The rate of increase in population and motor vehicles will be markedly less in the next ten years than in the past ten years, and ample opportunity will be afforded the highway builder so to plan his development as to keep abreast of changing conditions.

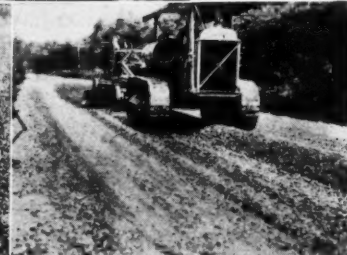
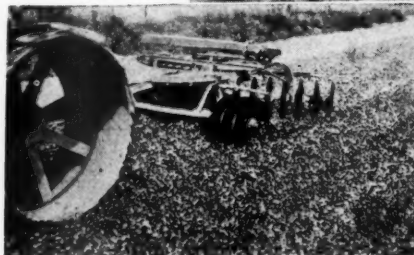
3. Certain trunk highways on which traffic flow is already

(Continued on page 82)

Top — Sand-clay road in Georgia; asphalt wearing course by surface treatment. Second — Loose sandy gravel in Minnesota; surface treatment by dragging and inverted penetration.



At left — Lime rock surface in Florida; treated with tar prime, hot asphalt seal. 4 years old.



Coarse aggregate type mixed-in-place surfacing in W. Virginia. Disking the mixture after second application. Smoothing out the mix with grader.

Abstract of a paper by Bernard E. Gray, before the annual meeting of the Michigan Engineering Society.

THE WATER WHEEL

Turning Round the News of the Month

By Isador W. Mendelsohn, C. E.

Design

The Colorado River⁷ as the only available source for additional water for the Metropolitan Water District of Southern California has been studied, and the best of 60 routes considered for the aqueduct has been adopted. This will require pumping, an aqueduct almost 270 miles long, terminal storage facilities, and an expenditure of \$220,000,000. It will furnish one million acre-ft. of water annually. The district was organized in 1928 to develop a domestic water supply for noncontiguous cities and is governed by a Board of Directors, at least one from each city, the voting power being distributed among the cities on the assessed valuation, and the water to be apportioned similarly. There are 11 cities in the district with an aggregate population of 1,850,000 and an assessed valuation of 2½ billion dollars.

The design of mixing basins⁴⁰ is receiving greater attention by engineers in laying out rapid sand filter plants. Prior to 1900 few if any of these plants had real mixing basins, and even as late as 1915 designing engineers were not convinced of the advantage of mixing basins for all rapid sand filters. At present the proportion of filtration plants with mixing basins may be 75 per cent according to Baylis. The tendency is toward increasing the time of mixing, about 20 minutes being allowed now. Types of mixing basins used are: (1) Chemicals applied to raw water pipes or conduits. A larger time is required for good flocculation than in basins designed specially for agitating the water. Long periods of mixing in conduits are impractical because of the necessity of applying the chemical a long distance from the rest of the plant. (2) Horizontal baffled basins (around the end). This is the most common. Baylis believes a velocity of 1.3 ft. p.s. for rated capacity best for highly turbid waters, and a velocity of 0.8 ft. p.s. most desirable for low turbidity waters. When the water is softened and a heavy precipitate occurs, a velocity between 1.5 and 1.8 ft. p.s. may be necessary. (3) Vertical baffled basins (over and under). It is not desirable to have a depth over 30 ft. due to increased cost. For small plants vertical baffled basins and basins using mechanical agitation will most likely be used. For 10-20 m.g.d. plants either vertical or horizontal baffled basins are suitable. In over 20 m.g.d. plants there is doubt as to the wisdom of using this type of basin. (4) Mechanical mixing. Baylis believes most softening plants in the future will have this type of basin, also many other plants. Two tanks are desirable. (5) Spiral inward flow. 1-2" should be the maximum loss of head in well designed mechanical mixing basins. The velocity should be about 1.5-3' p.s., the same as for straight conduits or for circular tanks with mechanical agitation. (6) Other types, such as the hydraulic jump, air agitation, etc.

The importance of a water supply⁶ to the develop-

ment of a city is inestimable. Improvements in the water supplies of Kansas City, St. Louis, New York, Louisville, Los Angeles, and many others attest this fact.

The new water supply of Orlando, Florida⁴⁸ was necessitated by the extraordinary growth of the city. The original system laid out in 1922 to serve until 1940 at least was found in 1926 to be approaching this limit by 1930. The new supply is from Lake Underhill, one of the many lakes in the vicinity, and has a potential storage of 1.1 billion gallons. All property on the lake front was obtained by the city. The total cost of the improvement was \$156,000.

Additions to the Melbourne and Sydney, Australia, water systems¹¹ provide for three dams and reservoirs for the former, and several for the latter, both supplies being from uninhabited watersheds. A dam 25 miles from Melbourne is now under construction across Sylvan Valley, to be 2,060' long and over 100' high at its highest point, and to store 8,800 m.g. This dam will be of earth embankment with a concrete core wall. The farthest dam project will be 80 miles away. The Nepean Dam now under construction for the Sydney system is of concrete with cyclopean masonry, 700' long and 268' high at highest point, and will store 22,625 m.g.

The East Bay Municipal Utility District's new water supply¹⁸ operated since June, 1929, is obtained from the Mokelumne River in the Sierra Nevada Mountains almost 100 miles off. The development includes Pardee reservoir, with 220,000 acre-feet of water, dam, and power plant; distribution line of 4 concrete lined tunnels, a reinforced concrete pipe, and a steel pipe; booster plant, aeration weir, screening chambers, chlorinating plant, and two large steel cylinder reinforced concrete transmission aqueducts. The present capacity is 70 m.g.d. and eventually 200 m.g.d. The district comprises 9 cities along the east shore of San Francisco Bay, 78,000 acres in area, with ½ m. population.

The design of sanitary drinking fountains⁹⁷ is stressed in the ten essential features adopted by the Conference of State Sanitary Engineers and the Public Health Engineering Section of the American Public Health Association at Fort Worth, Texas, October, 1930.

A survey of drinking facilities in 1500 places of employment³⁵ inspected in 21 states by the Women's Bureau, U. S. Department of Labor, showed: (1) In over 50 per cent of the establishments employees were not provided with drinking cups or used common cups, despite laws or regulations in 19 of the states prohibiting use of the common cup; (2) over 40 per cent of the establishments provided bubbling fountains for at least some of the employees, but less than 4 percent had angle-jet fountains throughout; (3) in most states these practices regarding drinking facilities in places of employment do not demand meeting the

best sanitary design; (4) the states differ widely in their requirements in this matter.

The efficiency of small pumping station units¹⁷ such as minor main service pumps, fans, stoker engines, sump pumps, motors for driving small pieces of equipment in the water purification plant, and boiler room equipment can be increased by careful analysis of possible plant performance, and by certain improvements in types of installations. A. D. Couch points out that in small plants under certain conditions it is false economy to make changes to raise the operating efficiency a few percent. K. Toensfeldt considers the selection of proper pumping plant equipment as of primary importance in preventing wastefulness, greater weight being given to economy in the choice of apparatus for large plants with fuel cost half the operation cost, and to first cost for small plants operating for part of the day.

Fifty Venturi meters adapted for irrigation service¹⁸ near Fresno, California, built of precast concrete tubes, and ranging in size from 16" to 42" consist of (1) a short entrance section of uniform diameter containing the entrance pressure connections; (2) the combined entrance cone and throat sections with the throat piezometer ring, and (3) the exit cone of gradual taper providing a return to the original diameter. Tests showed an average value of 0.960 for the coefficient of discharge. The relationship between discharge coefficient and throat velocity was found to be similar to the characteristics of standard Venturi meters according to the authors.

Calibration of 26 Venturi meters¹⁵ from 30" to 72" in diameter by accurate flow tests using the salt-velocity method for measuring flows indicates that coefficients are more constant for meters with a gradual transition from inlet to throat. The flow measurements were believed to be accurate to within 1 percent by Coghlan.

A 40-ft. contracted measuring flume¹⁴ of reinforced concrete accurately measures Arkansas River water laden with excessive amounts of silt and sand in a canal near La Junta, Colorado. Comparison of observed and computed discharges for flows from 128 to 1464 sec.-ft. shows a maximum deviation of 2.3 percent.

Arch dam stresses¹² as analyzed by Westergaard by the trial-load method include radial, twist, and tangential forces.

Determination of economic sizes of pipe⁹ for long pipe-line construction is independent of the purpose of the pipe and unit cost according to Harris.

Hydraulic service characteristics of small metallic pipes³³ tested at the Cambridge, Mass. filtration plant showed for 1½" and ¾" copper, red brass, admiralty metal, galvanized wrought iron, galvanized steel, wrought iron, and steel pipes with hot and cold water flowing continuously for 3 years: (1) high copper pipes suffered no significant hydraulic change with service, and no noticeable effects were associated with the differences in pipe diameter and water temperature; (2) the galvanized iron pipes showed deterioration with service, greater for the high (140°F) than the low temperature (36°F), and no marked difference between the flow characteristics of the two sizes of pipe; (3) the iron pipes suffered the greatest change, the service characteristics varying with pipe diameter and water temperature.

Construction

Construction of the new water system for Athens, Greece,¹ involved: (1) emergency measures for increasing existing sources of supply by cleaning springs,

equipping artesian wells with air-electric boosters, and driving galleries into water-bearing rock strata; (2) erecting Marathon Dam of concrete, 1200' long, 180' above old stream bed, impounding 1½ billion cu. ft. of water; (3) a horseshoe section (7½'x7½') tunnel 8½ miles long, with 5½ miles of smaller tunnels with sections 4'x5' and a cast iron siphon line; (4) main distributing reservoir of 42,000 cu. meters at Athens, with 8 other reservoirs of 100-5,000 cu. m.; (5) a cast iron pipe line system of 500 miles, 80-500 mm. in diameter, laid on both sides of the street due to the insistence of officials to avoid distributing the pavements; (6) a bond issue of \$10,000,000, half each by the contractor and the Bank of Athens, and the remaining \$3,000,000 by other sources; (7) an agreement between contractor, Bank of Athens, and the government regarding the operation of the whole project, including financing; (8) developing the physique of the Greek refugees from Turkey who were available for labor by building a commissary and employing a dietitian, and providing suitable sleeping quarters; and (9) building a power-house, transmission lines, railways, and a crushing plant.

The Hetch Hetchy Tunnel⁸ 10½' inside diameter through the Coast Range for San Francisco's new aqueduct is more than half completed for the 28.5 miles required. The tunnel is being driven from 14 headings, the shafts being 818' to 305' deep, midway between the present and second tunnel lines, the latter to be parallel and 175' south, and to provide an additional 300 m.g.d. when an increased supply in the future necessitates its construction. Air spades are used for the clay operations, air driven augurs for drilling slightly harder materials for shooting, and jack-hammers or drills for the harder formations. Gunite lining is being used extensively where squeezing and earth movement are giving most trouble. Due to natural gas in the tunnel workings at times, air drive mucking machines are used, and special precautions taken. All work is by construction forces of the city.

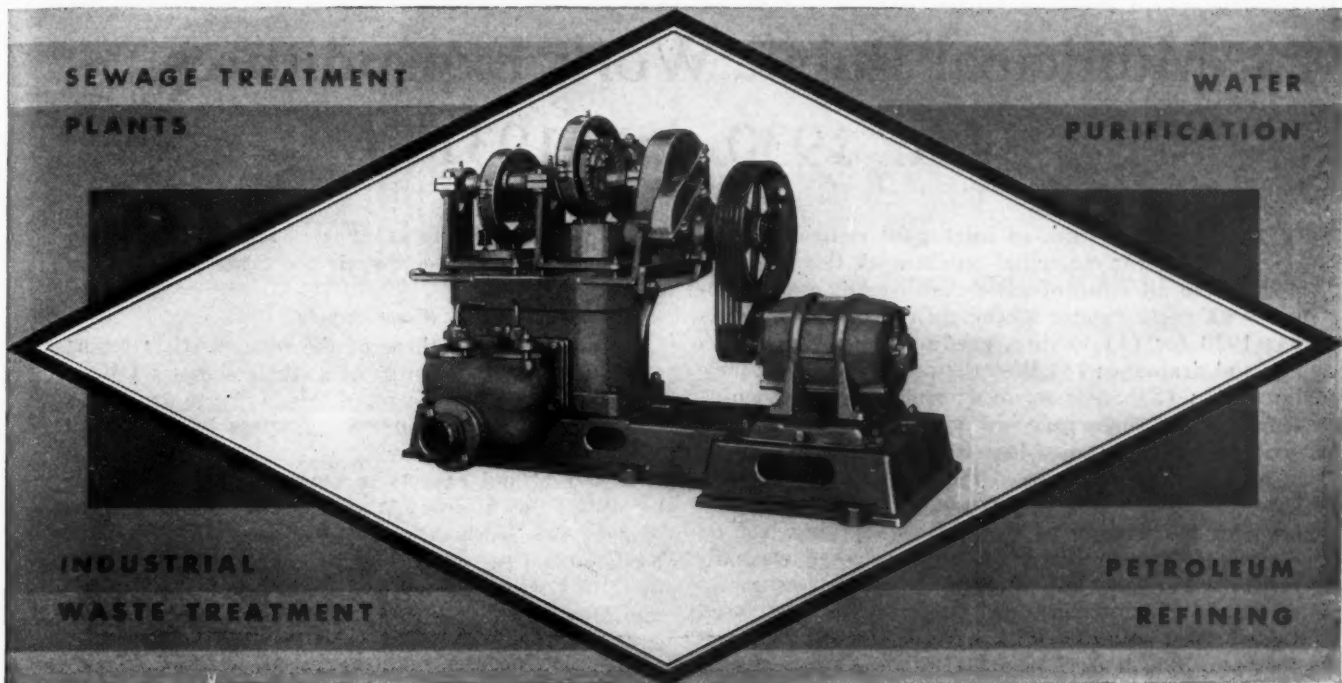
A break in the Mokelumne River aqueduct¹⁰ to the East Bay Municipal Utility District was located in a 54" steel pipe crossing the San Joaquin River by a diver in a pneumatic chamber or air lock so constructed that it could be moved through the pipe, stopped at any intermediate point and unwatered, so that the diver within could inspect the inner surface of the steel plates and locate a leak by inflow from the outside. A crack in the pipe shell was located and repaired with electric welding equipment, the diver and welder being in the air lock.

A submarine pipe line³⁰ of 1700'-12" c.i. from the mainland at Portland, Me., to Mockworth's Island in Casco Bay, and 6800'-8" c.i. between this island and Great Diamond Island was laid in a trench in 1929 at a total cost of \$109,500 to furnish Fort McKinley on the latter island with Portland water.

Laying the 8" steel pipe line⁴⁷ 3,924' long from Chattanooga, Tennessee, up Lookout Mountain to the standpipe which is 90' high and is 1534' above the city involved many construction problems. This main carries 700 pounds per square inches working pressure.

Foundation excavation for the Croyhee Dam¹³ in Oregon necessitated the removal of 38,000 cu. yd. of material from the 250' length of fault zone under the base of the dam 190' below streambed, by mining methods followed by replacement with concrete by 8-cu. yd. buckets from overhead cableway.

(Continued on page 62)



ANNOUNCEMENT

The Dorr Company announces that it is marketing exclusively the **Barnes Plunger Sludge Pump** in the fields of

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When writing, please mention PUBLIC WORKS

Municipal Public Work Expenditures

In 1930 and 1931

IN an effort to form an intelligent estimate of the prospects for municipal public work this year, we sent to all cities of more than five thousand population a questionnaire asking their expenditures during 1930 for (1) Paving, grading, etc.; (2) Sewerage and drainage; (3) Water supply; (4) Other public works; (5) Snow removal; and (6) Street maintenance; and those proposed for 1931. When about six hundred replies had been received, from all states of the Union, we tabulated them and present results herewith. As was to be expected, we found that a considerable number of the officials replying had no definite figures to give concerning proposed expenditures for 1931 and did not care to make any estimates of them. In making our estimate we have used figures from only those cities which gave expenditures for both 1930 and 1931.

In general, the cities seem to anticipate about the same expenditures this year as last. Totaling the expenditures of all the cities for all the purposes listed above, there is a difference of only 0.36 of one percent—a decrease for 1931.

Paving and Grading

Taking paving, grading, etc.—we find a greater sag than in any other line—a drop of 12.6%. It is believed, however, that this is due partly to the fact that in most cities paving is done largely by assessment, on petition of abutting property; and as the petitions for this year have only begun to come in, conservative city engineers have reported figures for “proposed expenditures” which will probably be increased later. Combining the cities by states, just half the states reported lower paving rates this year than last, 11 reported higher rates, and 13 figured on practically the same expenditures.

Assembling the states by the sections as used by the Federal government, we find the following percentage increases and decreases from the 1930 expenditures: New England, 5% decrease. Middle Atlantic, 14.5% decrease. South Atlantic, 26.7% decrease. East South Central, 60% decrease. East North Central, 10.7% decrease. West North Central, 4% decrease. West South Central, 8.4% decrease. Mountain, 36.3% increase. Pacific, 24.5% decrease.

Sewerage and Drainage

Sewerage and drainage occupies leading place in the optimistic column, with an expected increase of 29%. Moreover, the figures for 22 states show expected increases, and 12 others no decreases. By districts, only two of these—the South Atlantic and the Pacific—report expected decreases—13.6% and 53.6% respectively. The increases are as follows: New England, 4½%; Middle Atlantic, 21.3%; East South Central, 97%; East North Central, 29%; West North Central,

79.7%; West South Central; 76.5%; Mountain 151.4%. The increase for all the cities combined is 29%.

Water Supply

In water supply, three of the nine districts report a decline, and the country as a whole shows a falling off of 4.8%. A large part of this is due to one Texas city which spent \$1,750,000 for water last year and will spend little this year.

New England expects to increase its expenditures by 49%; the Middle Atlantic State to decrease by 45.7%; the South Atlantic to increase by 47%; the East South Central by 23%; the East North Central by 21.8%; the West North Central by 59.8%; and the Mountain by 22.4%. The West South Central expects to decrease 55.3%, and the Pacific 8.4%.

Other Public Works

“Other Public Works” total only about 8% of the combined expenditures for paving, sewerage and water. In this item four districts expect increases, four decreases, and one, practically no change. For the country as a whole there is expected an increase of 19.7%.

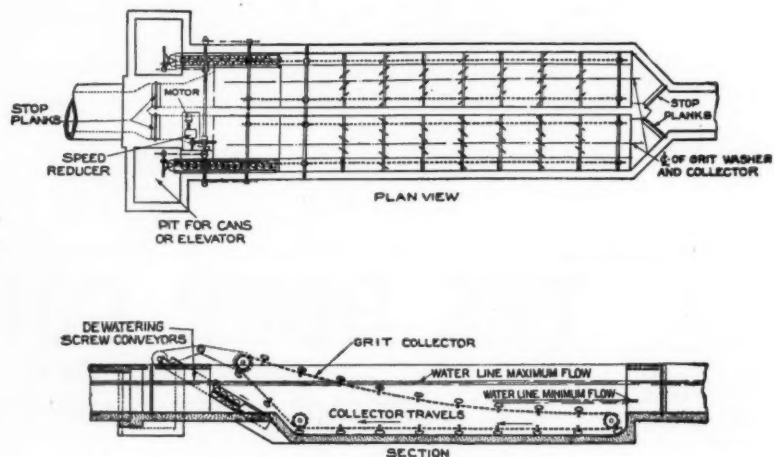
In snow removal, only one state, Wisconsin, expects to spend less this year than last, while eleven of the twenty states reporting on this item expect to carry on about the same as last year. The remaining eight account for an increase of about 18% for the country as a whole.

Street Maintenance

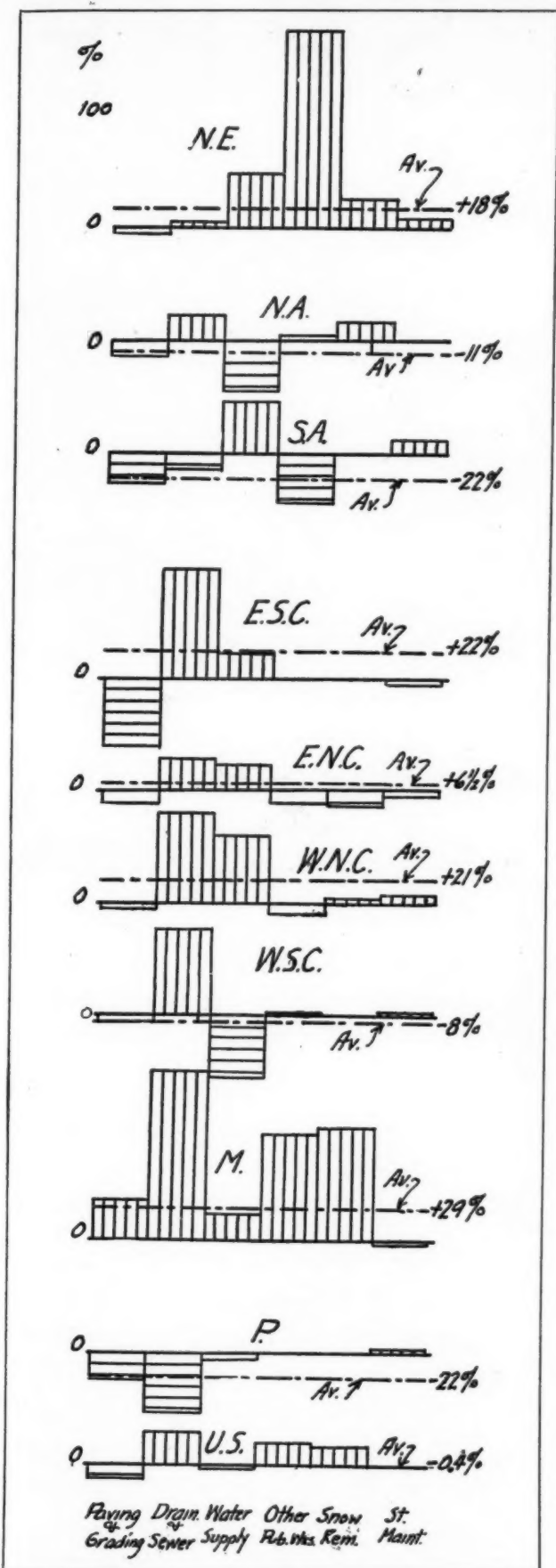
Street maintenance is one of those things that (fortunately) have come to be accepted as necessary, come good times or bad. Only six states expect to decrease expenditures for this purpose, and these by small amounts, while eighteen expect to increase them slightly. The net result is an expected change of less than 1%.

Totals by Sections

Totaling all the expenditures by sections, we find New England cities expecting to increase their ex-



Grit collectors and washers installed at Peoria, Ill.



Percentage increase or decrease of expenditures expected in 1931 compared to those in 1930, by geographical districts.

penditures by 18%; the East South Central cities by 22%; the East North Central by 6.5%; the West North Central by 21%; and the Mountain by 29.5%.

On the other hand, decreased expenditures are expected as follows: Middle Atlantic, 11%; South Atlantic, 22%; West South Central, 8%; and Pacific, 22%.

Removing Sand and Grit From Sewage

Many sewages, especially those from combined sewers, contain sand and grit, which it is desirable to remove before the sewage enters the treatment plant proper.

A settling tank with a velocity of about a foot a second will remove this grit, but as it is difficult to maintain such a velocity uniform across the section of the tank, a great deal of offensive organic matter settles out with the grit in many tanks. The removal of this mixture has usually been accomplished by means of grab buckets, and hand labor.

Many of the more recently constructed plants use mechanical equipment for removing this material and cleaning the sand. The illustration herewith shows a plan and elevation of the grit collectors and washers in use at Peoria, Ill., where a flow of 75 m.g.d. is handled.

The grit chambers are of rectangular shape, each 9 feet wide by 5 feet 10 inches effective depth by 40 feet long. Link-Belt grit collectors are employed for carrying the grit and organic matter to a screw washer with which one end of each chamber is equipped.

The flights on the collector are set at an angle to the direction of flow or conveyor travel, and serve to push the material along the bottom to one side of the chamber, as well as in a forward direction.

The speed of the collector is such as to provide sufficient agitation to cause the finely divided matter to go in suspension and only the grit and heavy organic matter are carried through the screw washer, by which the grit is separated from its admixture of offensive organic matter.

The screw washer has a scrubbing action on the grit, and places the organic matter in suspension, only the clean, dewatered grit being discharged out of the chamber by the screw. The capacity is large; therefore, continuous operation is necessary only during storm flows.

Light-Weight Concrete for Bridge Floor

The Wabash avenue bridge, Chicago, is a bascule bridge, for which reason the weight of the floor was an important consideration. That decided upon was a concrete in which the bottom 4 inches thickness was made using as aggregate a heat-treated clay and shale which is lighter than stone and reduced the weight of the concrete by about one-third. The top 1 3/4 inches was made using granite chips for coarse aggregate, giving a non-skid surface. This flooring was made in large slabs before being placed on the bridge, and welded to the structural steel.

The city council of Seattle has recommended appropriating \$800,000 for construction of a concrete reservoir, steel storage tanks and new pipe lines.



PUT SPEED



Cletrac Crawlers are built in a complete line of tractor sizes with a range of horsepower delivery from fifteen to a maximum of eighty. Five sizes.

SPEED is a factor on every job. It brings down costs and gears up the working schedule to a point of real efficiency.

With the heavy work about to start why not meet it with equipment that's **RIGHT** — that can put speed and economy into every job and crowd more jobs into the season.

Cletrac Crawlers are built exactly for this kind of performance — *to make work move faster and cost less.* They are powerful, dependable units that team up well with any kind of equipment on any type of work. Down in the mud of a levee-building job or on the surface of a highway their sure

CLETRAC

D INTO YOUR 1931 SPRING WORK



tread and uncompromising power make them equally effective — a sure match for big loads and hard pulls.

See the Cletrac dealer for a demonstration or write direct for full information on any or all models.

Whether you need the quick, mobile power of the small Cletrac "15" for a light job or want intermediate or giant power for heavier operations you can match your requirements with one or more of the five Cletrac sizes. With bulldozer, scraper or scoop train—with massive dirt wagons or elevating graders—there's a Cletrac Crawler to fit both the equipment and the demands of the job.

THE CLEVELAND TRACTOR COMPANY
 19322 Euclid Avenue Cleveland, Ohio



CRAWLERS

Metering Water an Economy in Greenfield

In his annual report for 1929 to the water commissioners of Greenfield, Massachusetts, Superintendent Harold L. Field stated that, although the precipitation was far below normal in 1930 and still lower in 1929, the amount of water available exceeded the consumption, the excess being greater last year than the year before. This happy condition he attributed to metering. During 1930 about a thousand meters were installed, and the consumption decreased until it became 250,000 gallons a day less than at the beginning of the year when only 700 services were metered. He estimated that by complete metering 500,000 gallons or more can be saved; and that the cost of metering would be less than that of adding this amount to the town's water supply.

Developing an Industrial Center in a Swamp

LESS than three miles from Manhattan, New York City, is a huge swamp twice as large as that borough, known as the Hackensack Meadows. Although situated in New Jersey, this area is included

in that being developed by the Regional Plan of New York and Its Environs, and it is proposed to develop it as a unit into one of the leading industrial centers of the United States, in which half a million population will live and find employment.

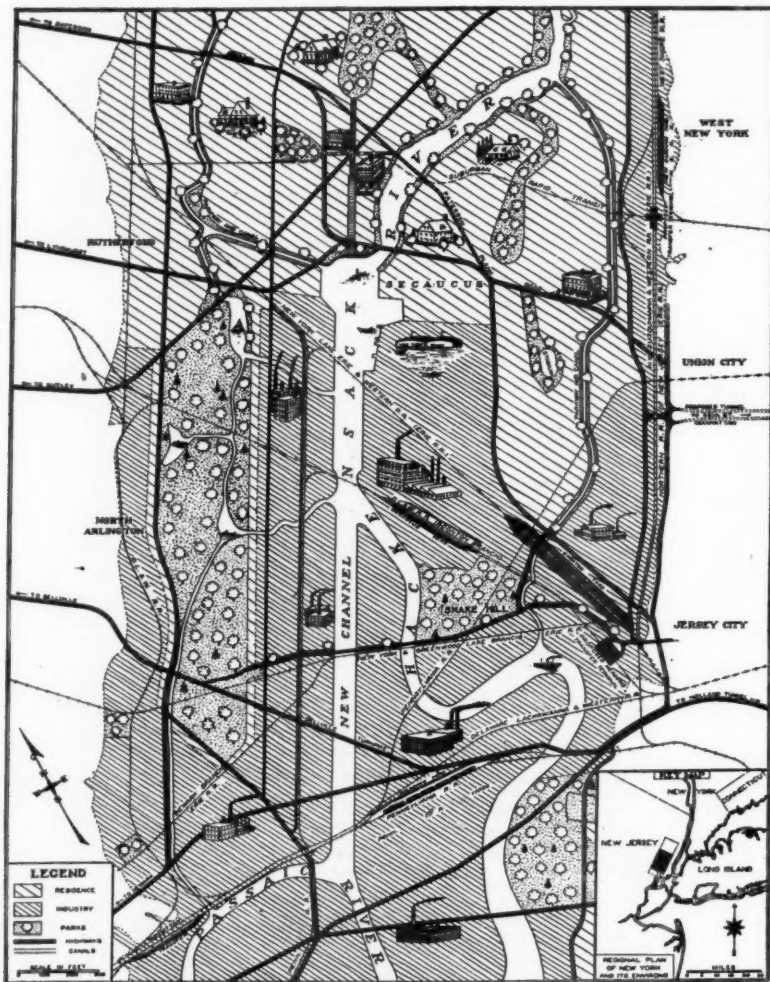
Plans have been prepared based upon a unified system of highways, railroad trunk lines, rapid transit lines and waterways to serve this area with local and long-distance transportation. The plan also includes a balanced apportionment of the land for industry, residence, recreation, and business uses. The central section of the meadows is shown on the accompanying map.

It is estimated that it would cost \$125,000,000 to fill in the meadows, but that this would be more than returned through the increased value of the land. The land would cost an average of \$483 an acre; reclamation would cost \$5,000; and partially improved land could be sold for \$2,370, and fully improved for \$10,130. These estimates are believed to be warranted by the experience of Newark, which reclaimed about 2,000 acres of similar land at a cost of \$15,000,000 which land is said to have a value now of \$36,000,000 and already contains \$75,000,000 of industrial improvements.

The Regional Plan's proposal involves the digging of a broad channel from the bend of the Passaic river to the Hackensack river; the building of a unified system of railroads, transit lines and highways; a park half again as large as Central Park, with numerous canals through it and also through parts of the residential and industrial areas. These canals, together with the proposed channel, would provide a large amount of the 172,000,000 cubic yards of fill needed for the reclamation. About 16,300,000 cu. yds. would come from the channel.

Of the 30,650 acres comprising the meadows and adjacent territory, 21,700 acres (70.8 per cent), chiefly in the northern part, are set aside for residential use; 3,990 acres (13 per cent) will be provided for new industries; 4,410 acres (14.4 per cent) will be devoted to parks and other recreational areas, and 550 acres (1.8 per cent) will be available for business uses.

It is believed desirable that most of the workers in the meadows industries live within a short walk or bus ride of their work, and a development is proposed with parks and playgrounds and parkways along the canals in the residential areas, and designed for safety from traffic. If provision for homes be not made, the meadows might ultimately contain industrial plants requiring 720,000 workers who would have to live long distances away and necessitate enormous expenditures for rapid transit facilities.



Proposed development of central part of Hackensack Meadows.

This part is shown in black on the small key map, the entire area of the meadows being shown by dotted lines.

RECENT LEGAL DECISIONS

By John Simpson

STREET IMPROVEMENT

Construction of Maintenance Clause in Paving Contract

The Louisiana Supreme Court holds, *Fresh & Oleviera v. City of New Orleans*, 169 La. 852, 126 So. 214, that a provision of specifications, made a part of a contract for the construction of subsurface drains, gutters, curbing and sidewalks, that the contractor shall maintain all work in good order and condition for two years from acceptance thereof, is broader than a mere guaranty to remedy defects, resulting from inferior workmanship or the use of defective material, appearing within the two year period. It includes the obligation to maintain the work in good repair for the required period, whether or not the repairs are required because of defects in the workmanship or because of the use of inferior material. But the provision, if it does not stand alone, must be interpreted in connection with other provisions bearing on the subject. It is held that the provision is not modified by other provisions requiring the contractor to repair defects in work, cracks indicating disintegration of the wearing surface, or surface irregularities due to defects in the foundation. The city, the court said, by these provisions sought to provide, as an incident to obtaining proper pavement or other similar work over a moist soil, that the contractor should repair any defects in the work, arising during the maintenance period, at least under ordinary usage, whether or not the defects were due to a failure to comply strictly with the specifications or to other causes.

The contractor was held charged with knowledge that there was danger of subsidence occurring in the work at places, by the fact that the specifications made it his duty, before bidding, to investigate the conditions to be encountered, and the fact that there was danger of subsidence was a condition easily ascertainable. Presumably, the court said, the contractor took into consideration this particular danger to be encountered and based its bid accordingly.

The rulings in other cases on this subject, the court said, depend largely upon the particular provisions in the maintenance or guaranty clauses there involved, which scarcely, in any two instances, are sufficiently similar to make the cases very pertinent. It cited, however, cases in the New York, Kentucky and federal courts as having a direct tendency to support the conclusion reached.

Provision for Drainage in Specifications of Grading Improvement

In an action by a contractor to enforce a lien on the property of an abutting owner for work done in the improvement of a street, it was contended that the contract provided for grading and drainage, whereas nothing was said about drainage in the ordinance. This contention was rejected, *Janutola & Comadori Const. Co. v. Taulbee*, Kentucky Court of Appeals, 16 S. W. (2d) 1026, because the ordinance provided that the improvement should be constructed in accordance with the plans and specifications on file in the office of the city engineer, and the plans and specifications provided that the work done should include "all grading, clearing, grubbing, shaping and trimming road-bed, shoulders and ditches, constructing all drainage," etc.

Validity of Paving Certificate

It is not necessary for the holder of a paving certificate, providing that all proceedings with reference to making the improvement have been regularly had, to allege or prove that all the steps prescribed in the charter and general law have been complied with. The introduction of such a certificate in evidence constituted prima facie evidence of the facts therein recited. Where the property owners did not appear at hearings regarding the proposed paving and filed no suits within the time prescribed by statute, they could not defend a suit on a paving certificate on any grounds except those rendering the assessment wholly void, and they waived any irregularities in the proceeding.

Widening the pavement at a curve, and reinforcing it with steel where laid over water or sewer mains were not such material changes as would vitiate an assessment therefor. *Scanlan v. Gulf Bitulithic Co.* (Tex. Civ. App.) 27 S. W. (2d) 877.

Discretion Left to Contractors Under Paving Specifications

The award of a concrete paving contract was held not to be objectionable for indefiniteness in requirements concerning materials or unlawful discretion conferred upon the contractor, where the specifications called for one part of Portland cement, two parts of sand and four parts of broken rock or stone by measure, with the proviso that the proportions might be changed by the contractor whenever voids in the materials used were not filled by use of the ingredients in the specified proportions. It was held that the discretion authorized was reasonable. While it is desirable to have all details precisely fixed as far as reasonably possible, allowance must be made in practice for contingencies bound to arise in every piece of actual construction. Some discretion must therefore be conceded, and though a measure of practical judgment is exercised by the contractor, the property owners are safeguarded by the requirement of fulfillment of the contract under the direction and to the satisfaction of the city engineer. There was nothing to indicate that the discretion authorized would have any bearing on the cost of the work proposed or any appreciable effect upon the assessments. Public contracts, the court said, as well as private contracts, must be dealt with in a practical way. They are intended to get beneficial results, and, while the property owners' rights must be protected by due legal procedure and such definiteness and certainty in plans and specifications as will guard against jerry-building and dishonesty, the tendency to strain at gnats is to be deprecated.

The specifications were held not defective because of a clause declaring that the contractor, if requested by the engineer, should furnish tests of the cement to be used made by some reliable chemist, to conform to specifications required by the American Association of Civil Engineers and the American Society of Testing Materials, the cement to be Portland Cement, to be delivered dry and properly branded. There was nothing to show that the specifications of the organizations mentioned are not commonly accepted as trustworthy standards.

The details of the implements for mixing materials and the material used in curing the pavement were

held properly left to the expert judgment of the engineer as supervising officer.

A provision of the contract that the concrete pavement be "not less than the thickness shown on the plans, after being thoroughly tamped," was not objectionable, the plans and specifications being always available to the contractor.

A clause in the specifications requiring the contractor to furnish necessary work or material unintentionally omitted in the description of the work, was held not objectionable. *Rice v. Hanrahan Co.* (Cal. App.) 285 Pac. 414, affirming judgment for the defendant contractors in an action to enjoin performance of street work by owners of property within the district assessable for the work.

CONTRACTS AND CONTRACTORS

Reletting Contract on Failure of Contractor and Surety to Complete

When a road contractor and his surety fail to complete a contract, their liability for such damages as may be suffered attaches the moment they are put in default. The reletting the work under a condition, or subject to a term, differing from the former contract, in order to complete the undertaking, does not alter the prior contract, and does not, of itself, discharge the principal and surety thereof. But the changed condition or new term may have the effect of virtually discharging the principal and surety, by rendering proof of the amount impossible.—*State v. Smith*, 167 La. 301, 110 So. 56. Where, however, the work to be done under the new contract is the same, and is to be done in the same location and manner, as under the former contract, it is possible to make such proof.

Owner's Delay in Protesting Paving Project

Under the Louisiana Act 115 of 1922, if a property owner fail to protest within 30 days after the publication of the notice that paving is to be done, he cannot interfere with the progress of the improvement. For greater reason he cannot defeat, on account of irregularities in the proceedings, an action for the cost of the work after it is done. *Town of Ruston v. Adams*, Louisiana Court of Appeals, 121 So. 661.

Lowest and Best Responsible Bidder

The Illinois Appellate Court holds, *Goss v. Board of Education*, 247 Ill. App. 58, that the mere fact that the bid of the successful bidder for a contract to plaster a school for \$29,000, was \$200 in excess of the lowest bidder, the rule of the board of education providing for letting to the lowest and best responsible bidder, did not impute fraud or justify enjoining the contract. If the board concluded that because the extent and volume of the work already awarded to the lowest bidder might interfere with the promptness with which the work would be completed, that, it was held, would not justify judicial interposition.

Subcontract for Delivery of Crushed Rock

A provision in the Nevada Highway Act that no contractor shall let any subcontract except upon the written approval of the highway department is a provision incorporated in the statute for the benefit of the state. It does not provide that such a contract is void. Even the state may waive the provision. Where the highway department knew of a subcontract for the delivery of crushed rock and accepted the rock loaded upon the cars in pursuance of the terms of the contract

with the road contractor and of the subcontract, the Nevada Supreme Court holds, *Leech v. Armstrong*, 283 Pac. 396, that the subcontract was not void, and, after the highway department declared the principal contract forfeited for failure to make delivery thereunder, the subcontractor could not recover on quantum meruit, that is for the value of the work performed in crushing and delivering the rock that was delivered, rather than on the subcontract. The principal contractor, on the other hand, could only recover from the subcontractor the difference between what he would have received from the highway department and what he would have paid the subcontractor, if the latter had fully performed his contract.

Surety's Equity in Funds Due Contractor

The rule is well settled that, independently of assignment, the surety on a contractor's bond who completes the contract on default of the contractor is subrogated to the rights of the obligee and, to the extent necessary to reimburse himself, has an equity in the funds due to the contractor which is superior to that of a mere assignee. This superior equity, it is held, *Lacy v. Maryland Casualty Co.*, C. C. A. 4th circuit 32 Fed. (2d) 48, extends to the retained percentage as well as to the current estimates payable under the contract. A surety who advances money on the contractor's insolvency and finally takes over the contract is entitled to the funds due to the contractor to the extent necessary to reimburse himself although the work was not interrupted and no notice of default was given.

Contractor's Offset Against Subcontractor's Claim

Contractors against whom a subcontractor recovered a default judgment for work and materials could not enjoin the execution of the judgment because of the contractors' claim against the subcontractor for the rental of a dredge and the payment of the subcontractors' bills for materials and labor, without showing that the contractors were prevented from presenting this defense in the action against them by fraud or accident, unmixed with their own negligence. *Jenner v. Murray*, C. C. A., 5th circuit, 32 Fed. (2d) 625.

Failure to File Contractor's Bond

The Arkansas Supreme Court holds, *Benton County Lumber Co. v. National Surety Co.*, 18 S. W. (2d) 1017, that the failure of the parties to file a public contractor's bond in the office of the clerk of court as required by the statute does not affect its validity as a statutory bond, on which a materialman must bring action within six months. All persons, before furnishing labor or materials, can ascertain whether a bond has been given by applying to the owner as easily as by applying to the clerk.

Premiums on Guaranty Insurance

The state highway commission of Oklahoma has no authority to disburse funds appropriated to it by statute in payment of premiums on the guaranty insurance mentioned in the state Workmen's Compensation Law.—*Leininger v. Minter*, Oklahoma Supreme Court, 281 Pac. 801.

Furnishing Trucks Not Labor Within Lien Law

The furnishing of automobile trucks and drivers to a road contractor does not give a claim for "labor" within the New Jersey Municipal Mechanics' Lien Law. *Cramer v. Board of Chosen Freeholders of Salem County*, New Jersey Court of Errors and Appeals, 147 Atl. 639.

Equipment on Recent Levee Work, Memphis District

Some tractors and wagons are completing their third year on strenuous levee work and still going strong. Wagons average 200 cubic yards a day.

THIRTY-FOUR tractors, thirty-three large-capacity crawler and wheel wagons, and seven elevating graders are moving dirt on the loop levee, pieces 26A and 26B, just across the Mississippi river from Memphis, Tenn., which aggregate 1,800,000 cubic yards of levee. This equipment, during the month of December, 1930, moved 215,226 cubic yards of dirt. The average height of completed levee will be 25 feet, with a maximum height of 31 feet.

The contractors doing these two pieces of work are some of the best-known dirt-movers along the river—the Lowrance organization, with Blair Lowrance, Frank Stanford and F. S. Brown in charge. Piece 26A, of 900,000 cubic yards, was bid in at 23 cents

a yard; piece 26B, comprising the same volume of work but of a rather more difficult nature, went for 23.80 cents a yard. Brown-Dennison Contracting Co., Memphis, Tenn., and Blair Lowrance are handling the work on 26A; and Lowrance Bros. & Co., and S. K. Jones Construction Co., are doing 26B.

At the upper end, where the Brown-Dennison work is going on, with F. S. Brown in charge of construction, the contractors have one Caterpillar “60” elevating grader, loading into fourteen 4-up mule outfits and six crawler wagons. Three of these are Western 7-yard crawler wagons, and the other three are LaPlant-Choate, also 7-yard. There are nine Caterpillar “60” tractors on this job, which is located just south of West Memphis, across the river from Memphis proper.

Just below this section, Blair Lowrance is working an outfit of about the same size. He has two elevating graders, an Adams and a Russell, both equipped with power take-off. There are six Caterpillar “60” tractors, and nine wagons, three of them the new type



Above—Piling a full load into a 7-yard Austin Crawler wagon. Caterpillar tractors and elevating grader.

At the right—The new Streich solid-wheel wagon is being used. Note fire-barrel on elevating grader to keep operator warm.



Below—Caterpillar power-take-off elevating grader loading into La Plant-Choate 7-yard crawler wagon on Brown-Denison job.



Pavements cost you less when rolled with **ERIE** **ROLLERS**



You get these features in an ERIE

Instant smooth reversing
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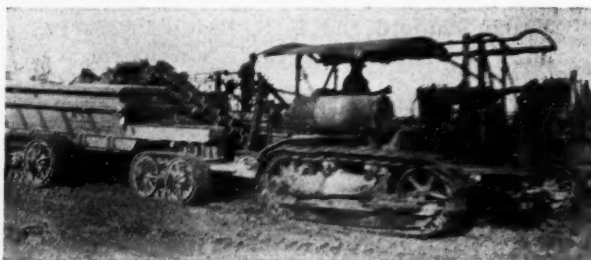
ISLANDS

DAVENPORT LOCO. & MFG. CORP., DAVENPORT, IOWA
Licensed Manufacturer for Wisconsin, Michigan, Indiana and States West of Mississippi River.

When writing, please mention PUBLIC WORKS

solid-wheel Streich wagon of 6 yards capacity. In addition, he has one Streich 7-yard crawler wagon, two Euclid 7-yard, two Western 5-yard and one Smith 5-yard, all crawler track wagons. This new solid-wheel wagon has performed particularly well so far, weather conditions having been favorable. If, under conditions of heavy mud, these wagons should prove less adaptable, the six crawler wagons maintained on the job can be used.

On the Lowrance Bros. & Co. contract on the north end of piece 26B, next to the Blair Lowrance job, are three more of these wheel wagons, and also a Streich 16-yard wagon with four crawlers, which is being given a tryout in the hard school of levee construction. In addition to these, there are seven LaPlant-Choate wagons, three of them 5-yard and the others 7-yard; and three Smith 7-yard crawler wagons. There are three Russell elevating graders with power take-off, two of which are used for the day shift and the other on the night shift. There are fourteen "60" Caterpillar tractors.



The new 4-wheel Streich crawler wagon behind a caterpillar tractor.

Excluding the new Streich equipment, the tractors and wagons on this section and on the section handled by Blair Lowrance are the same ones that built the Fidler bend levee some 40 miles above Vicksburg in 1928 (described in PUBLIC WORKS March issue, 1929), and were last year engaged on the Pecan Point job, about 30 miles up the river from the present job (described in PUBLIC WORKS, February, 1930). The continued economical use of this equipment under the severe and exacting conditions that exist in levee construction work, is conclusive proof of the soundness of design and excellent structural quality. If tractors and crawler wagons will operate for three seasons and more on levee work, their limit of life on road building and similar construction work should be very much longer.

In charge of this particular section of the work is Frank Stanford, long regarded as one of the best dirt movers along the river, and one of the "kingfish" in the Lowrance organization.

Night work is carried on with about half the force in action. A Kohler portable light unit furnishes the power for illuminating the work. To insure ready portability, it is mounted on a wagon.

The final and most southerly section of the work is being put up by the S. K. Jones Construction Co., which has a comparatively small force on the work. There are five Caterpillar "60" tractors, one Russell "60" elevating grader with a power take-off, and four crawler wagons, of which two are 5-yard Westerns with flashboards to increase their capacity, one is a 7-yard Western and one a 6-yard Euclid.

The city council of Seattle has recommended appropriating \$800,000 for construction of a concrete reservoir, steel storage tanks and new pipe lines.

LIVE CATTLE lose 49% LESS weight on these tires—



ZONE OF WEAR—where extravagant claims go "on the spot." At this point of contact heavy loads, rough going, high speeds and fast curves show up a tire's true quality. Here Goodrich Water Curing proves the uniform toughness it puts in a Silvertown.

Survey shows Silvertown Balloons PROTECT both LOAD and TRUCK

ENGINEERS of The B. F. Goodrich Rubber Company recently made an unusual survey to determine just how much balloon tires for trucks contributed to more efficient handling of perishable and fragile loads. The findings were astounding.

Tests showed that livestock in transit lost 49% less weight when the trucks were equipped with Goodrich balloon tires as compared with high pressure tires.

One large shipper of cattle in Glencoe, Minnesota, observed that weight shrinkage resulting from regular type tires was reduced as much as 75%

by equipping his trucks with balloons.

Yet Goodrich balloon tires not only protect the load...they also protect the truck and the driver, saving considerable in hours and dollars.

The Goodrich Truck and Bus Tire Distributor can help you answer that important question—"Would balloon tires prove most economical for my trucks?"

The B. F. Goodrich Rubber Co., Est. 1870, Akron, Ohio. Pacific Goodrich Rubber Co., Los Angeles, Calif. In Canada: Canadian Goodrich Co., Kitchener, Ont. The International B. F. Goodrich Corp. (Export).

Why BALLOON TIRES?

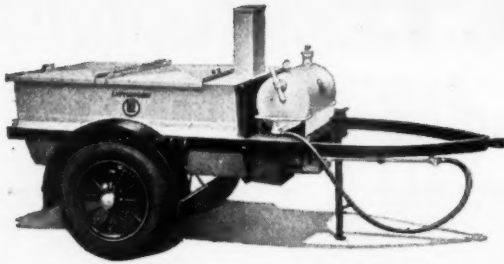
30% more mileage—says a fleet operator. 10 m. p. h. faster—from an inter-city express company. Greater traction—reports the contractor. Repair costs cut—the garage superintendent. Easier on the load—the records of a moving and storage house. More towns per day—a word from the delivery man. Less fatigue at 5.30 P. M.—the truck driver. Heavier loads over hotter roads—from the Imperial Valley, California.

Goodrich Truck Balloons

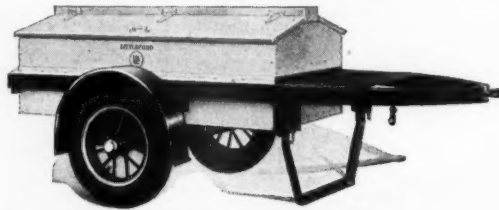
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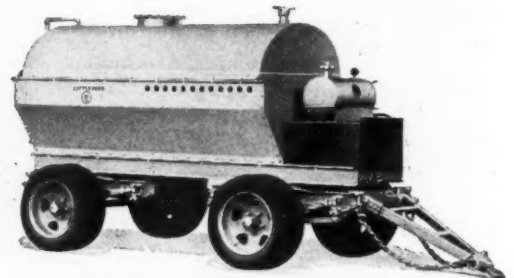


Heavy Duty Maintenance Kettle No. 84-HD equipped with pneumatic tires, semi-elliptical springs, Timken roller bearings, Double Heat Circulation, hot and cold material separating compartment. This kettle is made in 110, 165 and 210 gallon sizes.



Heavy Duty Tool Box No. T-1 equipped with pneumatic tires, semi-elliptical springs and Timken roller bearings. Capacities: 1 and 1½ tons. This tool box gives your tools the protection of All-Steel Construction.

Trail 'em FAST...



Distributor Supply Tank No. 97 equipped with dual-pneumatic tires, semi-elliptical springs and Timken roller bearings. Made in 600, 800 and 1000 gallon sizes. It has Double Heat Circulation which means faster melting of asphalt.

Asphalt Kettles
(Oil and Wood Burning)
Asphalt and Emulsion Sprayers
Tool Boxes
Tool Heaters and Surface Heaters
Water Heaters and Concrete Heaters
Steel Mortar Boxes
Salamanders
Joint Fillers
Squeegee Machines
Tools and Pots
Traffic Line Markers
Grout and Mastic Mixers

We aim to please. When highway men need something new, we try to give it to them. This time it's pneumatic tires to give faster trailing speed. Many highway departments have asked for such equipment, and here it is! Trailing speed—35 to 40 miles an hour.

Why so much speed? Most of your trucks are equipped with pneumatic tires, aren't they? There is nothing efficient about holding a pneumatic tired truck down to a speed of 15 miles an hour to trail a solid rubber tired asphalt kettle. When both truck and kettle can travel 35 or 40 miles an hour, you are saving valuable time. That's why we are supplying many highway departments with pneumatic tired asphalt kettles! They can make one kettle serve where two were used before!

Will pneumatic tires hold up? Better, much better than solid rubber tires! They are made for high speed and they are well protected from the heat of the kettle. Littleford kettles, because of their Double Heat Circulation construction, radiate very little heat—it is absorbed within the kettle. But in addition, the pneumatic tires are well protected by heat guards between the tire and the kettle, thus forming a space for circulation of air and absolute protection for the tire.

Pneumatic tired equipment was displayed by us for the first time at the recent St. Louis Road Show. This was after we had tried them out on our equipment for more than a year. The experiment has been successful. Let us tell you how you can speed up operations—send the coupon now!

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New York City's New Refuse Collection Trucks

New York City has bought two hundred and four trucks for removing garbage and ashes which are different from any before used in that city. They were obtained on bids received, based on specifications prepared by the engineers of the Street Cleaning Division of the Department of Sanitation under the direction of Dr. William Schroeder, Jr.; one aim being to secure a type of body which would minimize the nuisance of dust and odors connected with the old open-body collection.

Two types of body were selected, one made by Fitz Gibbon & Crisp of Trenton, N. J., the other by the Wood Hydraulic Hoist & Body Company of Detroit, the order being equally divided between the two types. All are mounted on Model SCHSB Autocar Chasses.

The Fitz Gibbon & Crisp bodies are all metal, with 16 yards capacity. The hoisting mechanism is the Fitz Gibbon & Crisp rotary hoist. On these bodies the side panels are balanced by springs and roll up like the top of a desk. All these side panel openings can be open at the same time. The tailgate mechanism is controlled from the driver's seat. The top panels or doors open on hinges by means of individual handles. These doors are used only in connection with the operation of the units as snow-removal trucks.

The bodies supplied by Wood Hydraulic Hoist & Body Company have a capacity of 12 cubic yards and

are elevated by the Wood mechanical hoist. The side panels slide horizontally on rollers. They are hand operated by means of handles and pawls which are provided for each panel. Two of these sliding panels can be opened on each side of the truck at the same time. These openings are used in the normal work of collecting ashes and rubbish. The action of the tailgate is controlled from the driver's seat. These bodies also are equipped with top panels for use in connection with the work of snow removal.

Several of the trucks are painted in the city's official colors—white bodies with orange trim and blue running gear. If this proves to be as serviceable as the old tan and black paint, the color scheme will be carried out on all the new trucks.

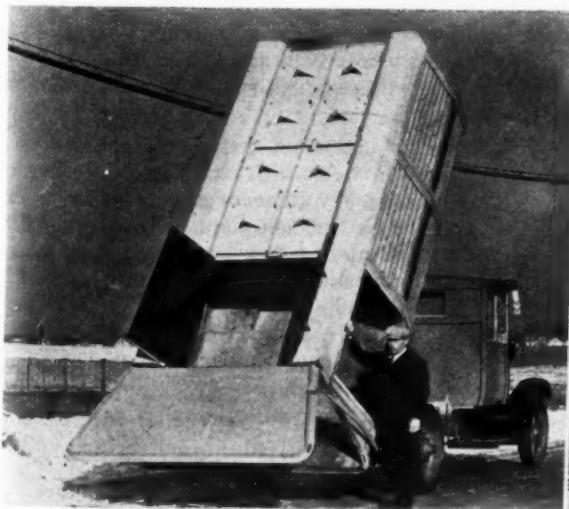
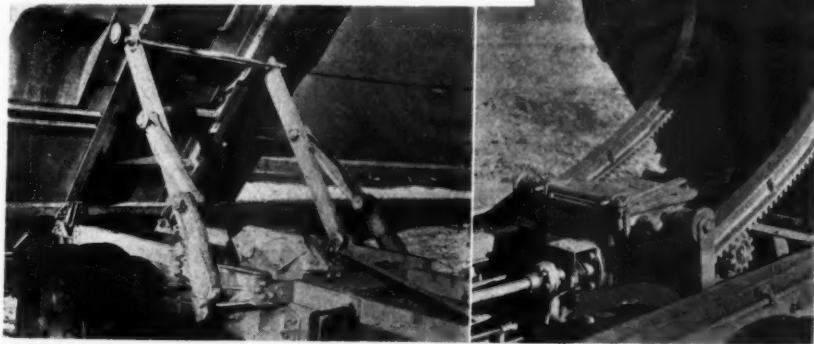
When the first shipment of 20 of the trucks in this order was received in New York, appropriate ceremonies attended their dedication. Together with some of the old horse-drawn vehicles, the new Autocars were publicly displayed in front of the City Hall while the Sanitation Department band played "The Old Gray Mare; She Ain't What She Used to Be." The trucks were accepted on behalf of the city by Dr. William Schroeder, Jr., head of the Sanitation Commission of the City of New York and Mr. Charles F. Kerrigan, Assistant to Mayor Walker.

Assessing Costs of Public Improvements

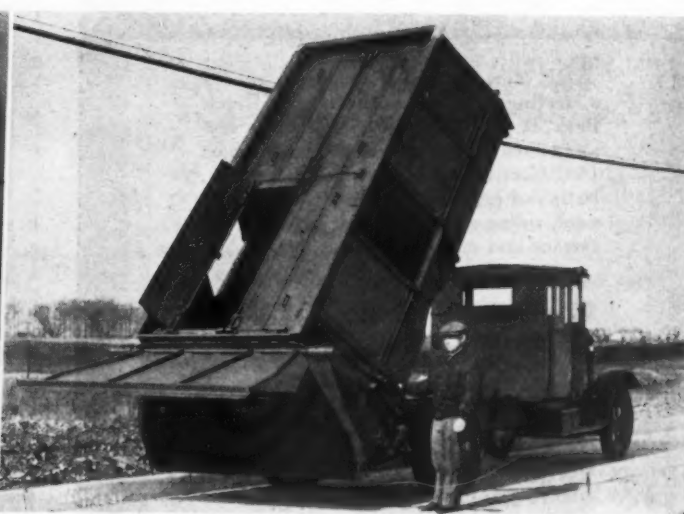
The question which has given so much trouble to many other cities, with regard to distribution of costs between city and property owner on improved main traffic arteries, has arisen in Kansas City, according to a recent issue of the bulletin, "Public Affairs," published by the Kansas City (Mo.) Public Service Institute. One group proposes that the entire expense be paid from a bond issue, while a special committee on the subject has proposed that the city should pay one-fourth of the cost of land and improvements taken, one-half of the grading cost, and all of the cost of structures such as viaducts and underpasses.

Below—Detail of the Fitz Gibbon & Crisp rotary hoist.

At right—Detail of the Wood mechanical hoist.



Sixteen-yard Fitz Gibbon & Crisp body



Twelve-yard Wood body.

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TEN MINUTES FROM THE WHITE HOUSE

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Allowable Grades for Highways

(Continued from page 28)

must be imposed on traffic and for which grade and alignment will be responsible, future traffic conditions and the adaptability of present design to future use is important. If permanent alignment could be secured at reasonable outlay by employing the maximum grade, the latter would ordinarily be allowable. If, however, an appreciable difference in grade rate allows but a moderate improvement in alignment, the better grade would most often be preferred. For instance, having alternatives of 1000 ft. radius curvature and 6 percent grade, or 500 ft. radius curvature and 5 percent grade, the best alignment would be chosen as a permanent standard, other conditions being equal. But were the alternatives 500 ft. to 1000 ft. radii on 6 percent grades, versus 500 ft. radii on 5 percent grades, the latter is preferable because curvature is zoned and the grade would unquestionably be superior for general traffic.

Zoning curvature, to have adjacent curves consistent in degree of curve to avoid sudden changes from light to heavy curvature, with transition in standard covering an appreciable distance, will also prove beneficial in inducing more uniform grade lines. Combining variable grades with variable curves introduces hazards when the standards are low. Speed of vehicles on descending grades justifies limitations in gradient more than does the advantage to the ascending traffic.

To overcapitalize the importance of reducing grades and increasing radius of curvature when wide roadways are required is sometimes inconsistent. A wide roadway implies heavy traffic which, as it approaches congestion, is limited in speed for uniform travel. No better grade and alignment standards are required for such a section than are required for a narrower roadway handling its proportionate volume and class of traffic. With speed of travel on the increase, the tendency is to hold grades to a moderate maximum for the composite vehicle, to avoid curvature that necessitates heavy superelevation, and to eliminate grade breaks that obstruct vision. If a two-lane road is a potential four-lane highway, grade standard will not be set by present volume. The difference in construction costs of the narrow and the wide road on the different grade standards will probably show a proportionate difference in economic grade values for the relative volumes due to width. On *minor* roads an increase in allowable grade maximum is made at sacrifice of other traffic advantages, wherein costs of construction are more serious than disadvantages to small volume of traffic.

In design of important commercial highways, the grades allowable deal with volumes of traffic composed of so large a volume of the heavy commercial vehicles that their efficiency in high gear controls maximum. Within such low limits of gradients, fuel consumption, at grade separation ramps, for instance, is not an appreciable factor. Uniformity in speed during peak traffic periods which increases roadway capacity and safety is all important.

Grade separations and structure approaches on the open road can usually be constructed with maximum 4 percent grades. Good visibility on vertical and horizontal alignment at the structure are essentials. Into design must be built a margin of safety to give a

(Continued on page 60)

The 1930 Drought and Public Water Supplies

By Isador W. Mendelsohn, C. E.

Last year's draught, possibly the greatest experienced in this country, affected at least 21 states located largely in the Mississippi and Ohio river basins. Fragmentary as are the data available, the information at hand is sufficient to indicate the extremely serious effect of sub-normal rainfall upon public water supplies.

Commencing in June, 1929, and extending to October, 1930, there was built up a considerable deficit of rainfall in Massachusetts, according to Weston. In 1929 surface water only was affected, but in 1930 ground waters also were influenced, so that many wells dried up. Twenty-four cities were forced to use emergency sources or to consider doing so. One town voted unanimously for a public water supply, where previously this proposition had been defeated. Taunton, which takes its water from the largest fresh water pond in Massachusetts, had 6 inches less water than the lowest record in the past 37 years.

In Pennsylvania, Moses states that the southern section was the hardest hit. The flow of streams virtually ceased, leaving water works intakes dry, suction pipes exposed, and storage reservoirs empty. Various expedients were resorted to for augmenting public supplies.

In Ohio the drought necessitated curtailment of the use of water for sprinkling, and recourse to wells and old mine workings for additional supplies. The village of Caldwell used a highly polluted water as auxiliary supply, and the city of Struthers constructed a long pipe line to connect with a nearby city's supply.

Maryland cities suffered by the drying up of their stream supplies, necessitating the use of individual wells and springs, and the installation of new sources of supply. At Harve de Grace many residents were forced to abandon the public supply and use wells and springs because the salt content of the Susquehanna river, which is the source of supply, increased from 9 to 582 p.p.m. due to the inflow of brackish water from the upper Chesapeake Bay as the flow of the river diminished. At Port Deposit and Brunswick, additional water was pumped from rivers and heavily chlorinated.

According to Devendorf, many water supplies in New York have been seriously affected by the drought, the storage reservoirs on surface supplies being greatly depleted. In some instances auxiliary sources of supply were used; in others additional or new wells were drilled or new spring supplies developed. In all cases where water supply shortages have been experienced there are movements under way either to obtain new or additional sources of supply or to increase existing storage reservoirs. The long duration of the drought has resulted in depletion of water supplies where previously such shortages were unknown. For instance, the shortage at Gloversville was so serious as to necessitate the closing of manufacturing plants for three weeks until auxiliary pumping machinery and pipe lines to nearby ponds were installed, affecting 5,000-7,000 employees and involving considerable expense to the manufacturers. At Medina the depletion of the ground water supplies necessitated use of the

heavily polluted Barge Canal water. At first the canal water was inadequately chlorinated because the chlorinator on hand was of insufficient capacity, but this was immediately corrected with the purchase and installation of a larger machine. Fortunately there was no outbreak of water-borne disease.

The drought presents many interesting and important aspects concerning public water supplies. In the first place, so that engineers and sanitarians may be better informed and more fully prepared in the future, data as complete as possible should be collected from every state affected in 1930, to show the effect of the drought upon (1) water supplies; (2) typhoid fever and other water-borne diseases; (3) the development of public water supply systems, and (4) the measures taken by state departments of health for relief of water supplies. These data should cover (a) the population of each city concerned; (b) sources of regular water supply; (c) method of treatment; (d) daily water consumption before and during the drought; (e) the period of duration of the drought; (f) sources of auxiliary supplies during the drought, the methods of providing the additional water, and the methods of treatment; (g) emergency measures used to limit water consumption; (h) cases and deaths of any water-borne disease resulting from the drought; (i) any action taken by the city to provide against water shortage in the future; and (j) any measures taken by the state department of health to assist suffering communities.

This drought has impressed upon the officials of many smaller cities and towns, as previous arguments have not, the vital importance of an adequate public water supply. The larger cities have known this and for years past have been adding to their supplies to prepare for any emergency. Even during the drought, some smaller cities took action to provide for adequate public water supplies in the near future. Their example should and will be followed by many other cities and towns feeling the effects of depleted supply.

The absence of any outbreaks of water-borne disease due to the drought is very fortunate. Hurried use of polluted supplies with inadequate sterilization equipment probably occurred in an appreciable number of cases, but prompt and decisive action by the state departments of health, especially their sanitary engineers, together with the cooperation of local water supply and health authorities, were the deciding factors in preventing typhoid fever. In Pennsylvania thousands of water supplies were examined by mobile state department of health laboratories, and many department sanitary engineers assisted in the emergency sterilization of polluted auxiliary water supplies, so that in August, the peak of the dry weather period, no typhoid fever occurred which could be attributed to any emergency public water supply. Similar assistance was rendered by state departments of health in other drought affected states. The drought furnishes another illustration to the many at hand of the wisdom of providing state departments of health with strong sanitary engineering divisions to cope with public health emergencies.



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In considering adequacy of water supply, it is well to eliminate as much wastage in the present systems as possible. In the case of Hudson, New York, a pitometer survey made in 1929 undoubtedly resulted in preventing a serious water shortage during the drought. This survey revealed two large sources of water waste and many smaller ones. These were corrected and leaking fixtures were repaired as found in house to house surveys.

Allowable Grades for Highways

(Continued from page 56)

sense of security to traffic, even though the structure itself is a caution sign.

At grade crossings and road intersections, safety and flexibility of intersection design demands careful use of gradients as well as alignment. Visibility should not be impaired by vertical or horizontal curves.

Maintenance of roadway enters into grade design. It may overshadow other factors in many cases, as when exposure, snow removal, slide prevention, etc. are serious problems. Grade may be the flexible location item to avoid deep through cuts or attain positions more favorable for maintenance. Maintaining drainage and roadbed on steep grades has added costs in excess of the initial savings made by poor construction.

Type of surface plays its part in establishing allowable grade. The surface with a low coefficient of friction should not have as steep grades as would concrete. There are times when it is more economical to reduce grades through grading in order to utilize locally available materials for pavement, than to import a more expensive pavement.

On the ultimate analysis, the allowable grade standard that follows the above general principles resolves into a matter of providing safety while maintaining roadway capacity.

Economy in fuel consumption due to gradients becomes an item subordinate to safety. Other factors, such as distance, alignment and width, enter into the design in their proper relation and each one stresses elimination of hazard. The last resort in providing safety is by efficient control of the use of the road to overcome deficient design. The engineers' responsibility is to build safety into design, in so far as justifiable costs will permit, by grade, alignment and width. Of these three measures for safety, grade and alignment should provide efficiency on the initial roadway for the immediate capacity required, so additional width can correct for increase in volume. It is evident that the original design of grade and alignment must also evaluate the costs of future widening.

No Parking Allowed

The town which will house the working forces that are to construct the Hoover (Boulder) Dam will have no parking problem, for no parking in the streets will be allowed. The plan provides ample parking spaces conveniently arranged throughout the town. Moreover, although the town will be on a transcontinental highway, the highway will not pass through its business center; but neither will it pass through the slums or other undesirable sections. It is proposed to route the transcontinental traffic past government buildings and through parks and "choice residential areas."

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That is why CAREY service is depended on, just as confidently as Elastite Expansion Joint itself; both have been proved by the only real test — performance. Now is a good time to order your spring requirements of CAREY Elastite Joint, thus insuring that the material will be on the job when the concrete is poured.

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GENERAL CONTRACTORS
OMAHA NATIONAL BANK BUILDING
TELEPHONE ATLANTIC 2200
OMAHA, NEB.

Nov. 20, 1930

Philip Carey Company,
Keeling Bldg.,
Omaha, Nebraska

Gentlemen:

Attention: Mr. Sutherland

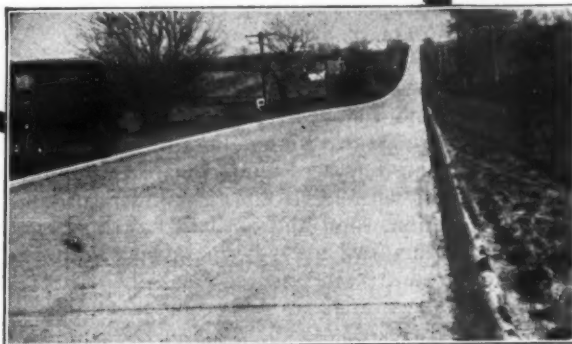
We wish to take this opportunity of expressing our appreciation for the good service you gave us in connection with furnishing us with material for our Blondo Street paving job. The material arrived on the job on exactly the day you promised us it would be delivered to us. Considering the short time in which you had to make shipment of this material we feel that the service rendered in this particular case was unusual.

Yours very truly,

YANT CONSTRUCTION COMPANY

BY *[Signature]*

RFW:2



Blondo Street, Omaha, Neb.

The Water Wheel

(Continued from page 38)

Successful bronze-welds in cast iron pipe³ necessitate care in the check of the welders, the selection and inspection of materials, design and layout of the joints, and the preparation for welding.

The water supply of Castle Rock, Colorado,³⁸ was increased 600 g.p. minute by constructing a collection system of 2400'-12" and 400'-15" perforated Armco iron pipe. A dragline bucket was used in excavating the gravel, sand and clay encountered.

In painting standpipes,³⁴ it is necessary to clean the surface of the steel plates thoroughly and then, when they are perfectly dry, to apply the paint. For the interior of the standpipe, the paint should contain as large a proportion of pigment as to permit its application in a thin film. The outside paint film does not need to be as hard as the inside. At least three coats of paint should be applied. Red-lead paint seems to fill the requirements of this service best.

Purification

Reclamation of treated sewage³⁹ for (1) direct augmentation of reservoir supplies; (2) replenishment of underground water supplies; (3) use for irrigation supplies; and (4) the development of new agricultural areas and production of a water suitable for various industrial purposes is being studied by the Bureau of Water Works & Supply of Los Angeles. A model 200,000 g.p.d. experimental sewage treatment plant for this purpose was placed in continuous operation May 12, 1930, and includes (a) clarification and disposal of sludge in a separate sludge digestion plant; (b) stabilization in an activated sludge plant; (c) filtration by coagulation with ferric chloride and returned sludge, sedimentation, sand and activated carbon filters, and superchlorination; and (d) final disposal on sand beds where ground water is replenished. Chemical and bacteriological analyses according to Gouder demonstrate that treated sewage is about the same as the Los Angeles system gallery water. Incomplete cost data include: (1) \$1,500,000 for a 25 m.g.d. plant, including separate sludge digestion, activated sludge, and chlorination, at a complete operating cost of 1.5 cents per 1000 g.; (2) a possible \$10,000 p.m.g. capacity additional installation cost for the filters, and operation at possibly 0.5 cents per 1000 g.

A code for filter plant operation²⁶ is given by Jordan as follows: (1) Write everything in the form of plant data; (2) know the immediate watershed; (3) observe and record the physical condition of the raw water hourly; (4) lighten the load for final chlorination by pre-chlorination, where the water prior to final chlorination shows 50 percent coli in 10 ml. quantities; (5) the turbidity of the settled water should seldom exceed 25 p.p.m.; (6) the filter material should show no coarse particles at the surface; contain few or no mud balls; and be level when dewatered; (7) effluent turbidities should rarely be higher than 1 p.p.m.; (8) effluent chlorination must be handled on a residual of preferably 0.1 p.p.m. after 30 minutes contact; (9) cleanliness should be stressed regarding everything; and (10) nothing but safe water is permissible.

Residual alum in North Carolina filtered waters²⁵ has been reduced through improvements in alum dosage by constant cooperation of the sanitary engineers of

the State Board of Health with the plant operators. It is possible to average well below 0.05 p.p.m. residual at times, although in winter the amount is somewhat greater due to the low temperature. Alum-free water is desirable for certain classes of industries, as bottling plants.

Prechlorination,¹⁹ according to Enslow, when used to give higher residuals in the applied water than 0.1 p.p.m. necessitates consideration of the filter primarily as an efficient strainer and no longer a biological unit. With prechlorination the filter bed has the property of storing up available chlorine and releasing it gradually. Before beginning prechlorination, the possibility of taste troubles with the raw water should be investigated; also the filter units should be given a heavy superchlorination treatment overnight and washed thoroughly to prevent filter bed unloading from residual chlorine in the applied water.

Chlorination at Chicago,²⁰ according to 1925-1929 results with a highly organized control system, gives a water meeting the U. S. Treasury Department standard. Even with high dosages, maintenance of residual chlorine during certain periods was difficult.

Iron in the Punta Gorda, Florida,²³ well water was reduced from 19.6 p.p.m. to 0.1 p.p.m. by aeration in connection with an upward flow gravel contact filter through a small cost 230,000 g.p.d. plant. The water sales doubled since the installation of this plant, the latter paying for itself in 4 months.

Collection of water samples⁴¹ necessitates attention to (1) representative character of the portion collected; (2) the vessel used as a receiver; (3) procedure of collection; (4) proper identification, accompanied by data regarding the source, and (5) prompt shipment.

The Dominick-Lanter new methylene blue bromocresol purple medium⁴ when tested at Rochester, N. Y., on 1116 water samples from 358 different sources proved superior to standard lactose broth for the detection of *B. coli* in water. (Ref. Public Works, Vol. 62, No. 1, Jan., 1931, p. 82.)

Management

Water-borne typhoid fever statistics⁵ for 1920-1929 inclusive show: (1) 242 outbreaks with 9,367 cases of typhoid fever, 630 deaths, and 84,345 cases of dysentery in the U. S., and 40 outbreaks with 2,836 typhoid fever cases, 145 deaths, in Canada; (2) 64.9 percent of the outbreaks in the U. S. and 77.5 percent of those in Canada occurred in small cities of 5,000 population and under; (3) a need for more thorough supervision and control over treatment processes, especially over disinfection where pollutional loads on plants are high or where chlorination is the only safeguard; (4) over 75 percent of the water-borne illness in the U. S. was due primarily to defects in the system for collecting, treating, storing or distributing the water for public consumption; (5) the most important single cause contributing to water-borne disease outbreaks was unprotected cross-connections between polluted fire supplies and public water systems; (6) in one city there were 5 repeat water-borne outbreaks from the same cause, and in 4 others repeat outbreaks from different causes; (7) courts are increasingly holding cities and water companies liable for heavy financial damages

for illness resulting from pollution of public supplies; (8) use of untreated surface and well water was responsible for 52.1 percent and 55 percent of the outbreaks in the U. S. and Canada respectively; (9) 17 outbreaks in the U. S. representing 594 cases of typhoid fever were due to interruption in chlorination where it was the only safeguard against contamination, in 6 instances the chlorinator being out of order and in the others it had been shut down.

A study of the effect of copper pipe on health³¹ according to Schneider shows: (1) the copper content of drinking water passing through copper pipes, even if a slight amount of copper is taken into solution, is not harmful; (2) when the quantity of copper taken into the human system exceeds 100 mg.p.d., the effect on the person is injurious, but it would require more than 54 g. of water with a high copper content of 0.5 p.p.m. to exceed the dose, and (3) the treatment of reservoirs with copper sulphate has no injurious effect on health.

The drought reduced New York²² stream flows in the southern and western parts of the state to record lows and caused water supply shortages in a number of cities and towns from July, 1930, on. Gloversville and Medina were among the cities whose water supplies were most seriously affected. No water-borne disease outbreak occurred due to the use of auxiliary sources of supply, largely because of the cooperative efforts of local and state health officials and the field work of the State Department of Health sanitary engineers.

The drought in Ohio³⁶ which has prevailed for 10 months and has affected seriously the water supplies of 46 smaller municipalities was relieved generally by a 1/2 rain Jan. 5-7. Blanchester, Woodsfield, New Concord, and Duck Creek were among the towns aided temporarily, while Barnesville does not seem to have benefited by it and is facing the need of using raw water bypassing the filter plant.

The water shortage in Maryland communities² under the Washington Suburban Sanitary Commission was relieved in August, 1930, by providing a 5 m.g.d. electric pump to force water from a reservoir in the District of Columbia's system to a gravity line supplying the communities, through the cooperation of the District.

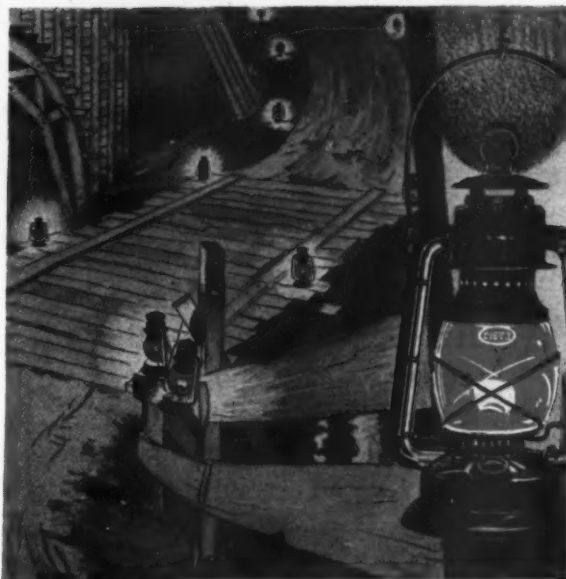
The new water supply system for Cumberland Hill,⁴⁵ a part of Cumberland, Rhode Island, was paid for by a bond issue of \$70,000 and serves 90 users. It consists of an intake to Snaech Pond, pumping station, 355,000 gallon standpipe, and distribution system, and is expected to furnish 300,000 g.p.d.

The Pilot tube and manometer or recorder²⁹ can be used to: (1) meter the discharge from a pump to determine the slip or pump efficiency; (2) to check large commercial meters without interruption of service; (3) to determine the flow in a main for which a permanent meter installation is proposed; (4) to measure the flow and loss of head in a pipe line in designing pipe lines; (5) to survey any part of a distribution system in considering extensions and reinforcing of the system; and (6) to determine leakage and waste and locate their sources. Complete control of the distribution system can be maintained by periodical water-flow and pressure investigations, in connection with a continual check by the water-works engineer.

Maintenance of water meters⁴⁴ in Longview, Washington, involved a cost of 7 cents per meter for repair parts exclusive of labor, and of 75 cents per meter for

(Continued on page 70)

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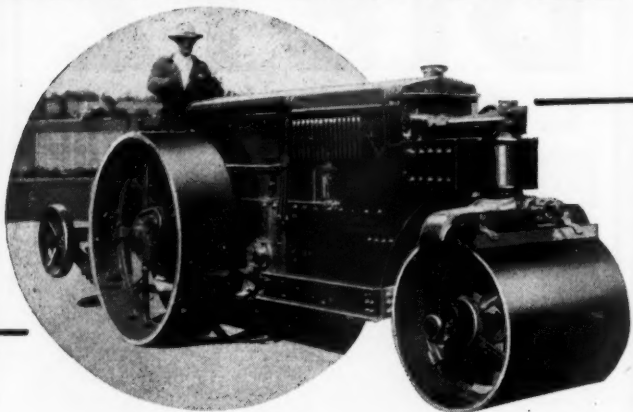
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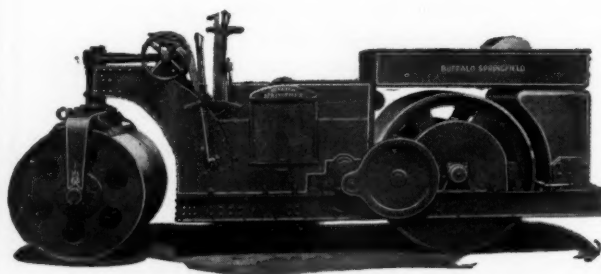


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Buffalo-Springfield ROLLERS

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(Continued from page 23)

2. While the yardage of pavements so resurfaced has been large, there is need for greater employment of this practice, as in many instances old pavements have been destroyed, and replaced by an entirely new structure at unnecessary costs.

2. Returns show that resurfacing can be done frequently for less than one-half the cost of a new pavement, and that the road or street can be reconstructed under traffic or in one-half width at a time, with a minimum inconvenience to traffic.

4. Further study of the subject is recommended with view to still further reduction in costs and speed of operations.

Engineering

1. Need for more forward planning of road and street improvements, so as to afford at least six months time in which to make all needed service cuts and drainage installations, and so take care of settlement.

2. In re-shaping old gravel or macadam surfaces to obtain a flat crown, or to improve profile, scarify the surface lightly and do not disturb subgrade.

3. Gravel and waterbound macadam surfaces should be carefully checked during the spring months to discover all weak and unstable areas. Carefully record these areas station by station, or drive stakes to mark the limits of the breaks. Do not trust to memory, as by next summer when the resurfacing is actually done, it will be impossible to tell where extra work is needed. Careful checking of this character insures uniform results with minimum expense, and lower maintenance in the future.

4. When in doubt as to bearing qualities of gravel or macadam and funds are limited, resurfacing should be either a surface treatment or a mixed-in-place surfacing, thus permitting easy reconstruction should additional thickness be required.

5. The use of asphalt emulsions is increasing.

6. The use of mixed-in-place asphaltic macadam is rapidly growing in favor for rural highways of light to medium traffic.

7. In resurfacing old brick, block or concrete pavements, carefully remove all broken or shattered areas, and replace with sound material, after remedying all faulty drainage. Carefully patch all depressions and irregularities with binder mix, to uniform cross section and profile. Place at least 1" of binder over whole surface and check carefully with ten-foot straight edge, prior to placing top course.

8. Binder course may be omitted only when surface heater is used to "burn" off all oil, grease and dirt, after which a light film of material is sprayed on, prior to placing surface course. Good results are obtained by this method.

9. 1½" sheet asphalt top course predominates in cities.

10. 2" to 3" asphaltic concrete predominates on rural roads.

11. Greater precision of method required, including steel side forms and machine methods of spreading, screening and finishing. In California on over 500 miles of resurfaced concrete and macadam, machine methods have reduced the cost and improved the surface to a remarkable degree.

12. Future pavement designs should be such as to provide re-surfacing as needed, with complete salvage of old surface, or minimum reconstruction.

13. Old surfaces thoroughly stabilized under years of traffic make better foundation than new concrete, due to absence of cracking.

Combustion of Organic Wastes

Heating values calculated by analysis in terms of protein, fat, carbohydrates and ash, and amount available for steam generation. Advantage of dry refuse over wet.

ELIMINATE the water of garbage, reduce it to a dry basis, analyze it in terms of protein, fat, carbohydrates and ash with a view to determining its fuel value, and there is little difference between the garbages of different cities. This is the conclusion of E. E. Butterfield, explained in detail in a paper before the American Society of Municipal Engineers. Also, he finds that the analytical method of determining fuel value checks very closely with the bomb calorimeter results.

As an illustration he reduces analyses of New York garbage of 1907, Washington, D. C. of 1914-15, and Philadelphia of 1928 to a common basis of 75% water and finds protein contents of 4.67%, 4.00% and 4.63%, respectively; fat 4.05, 4.94 and 4.70; carbohydrate 12.25, 12.75 and 12.78; and ash 4.03, 3.33 and 2.90. The total heats of combustion being given as 10,170 B.t.u. per pound of protein, 17,010 per pound of fat and 7,380 per pound of carbohydrate, the total heat of combustion of dry garbage can be calculated. Such a calculation made of 16 different garbages gave an average of about 8,750 B.t.u., varying from 8,495 to 9,186. Variations from the actual observed B.t.u. of these samples in no case exceeded 2¼%, and the difference of the average results was but 0.4%.

Mr. Butterfield believes that "this method of computing heating values is more accurate than the results of calorimetric bomb determinations on duplicate samples in different laboratories."

Considering rubbish, he divides the combustible materials in it into four main classes: Paper products, woods, other cellulosic derivatives and miscellaneous. The non-combustibles comprise mainly metals, glass and dirt. The amount of non-combustible matter varies widely in different cities; figures given by Hering and Greeley vary from 38% to 56% by weight.

Incombustible materials, leather, rubber, linoleum and oilcloth constitute about 1 to 7%, and cellulosic materials make up the remainder, with paper products dominating the fuel properties.

The weighted average for the heating value of the ash-and-moisture free combustible in rubbish combustible materials is 8,321 B.t.u. per pound. The proportionate heat of combustion of the dry rubbish substance in rubbish combustible materials is 7,257 B.t.u.

The above discussion uses the heat of combustion as determined in the bomb calorimeter and proportionately reduced figures for substances containing water. But the heat of combustion as determined in the bomb calorimeter is not that of a substance in a furnace, for the heat of condensation of water formed in combustion is measured in the former but is not available in the latter, where the temperature is always above the dewpoint.

Mr. Butterfield then considers: 1—Total heat of combustion. 2—Net heat of combustion. 3—Net available heat of combustion. The first is that developed in the bomb calorimeter. The second is No. 1 corrected for latent heat of vaporization by subtract-

ing 1040 (total hydrogen x 9). No. 3 is No. 2 corrected for hygroscopic moisture in the fuels.

For example: Taking 8,800 B.t.u. as average weighted value of total heat of combustion of garbage, dry basis. The hydrogen content of this, calculated from the proportions of protein, fat and carbohydrate, is 0.0667 lb. of hydrogen per lb. of dry garbage. The net heating value is $8,800 - (1040 \times 9 \times 0.0667) = 8,176$ B.t.u. per pound. But the garbage as received contained 72.13% of water and 27.87% dry substance. The net available heating value is therefore $0.2787 (8,176) - 0.7213 (1040) = 1,528$ B.t.u. per pound. This is not sufficient to heat the products of combustion and sufficient combustion air to the temperature of combustion; hence such wet garbage is not a true combustible.

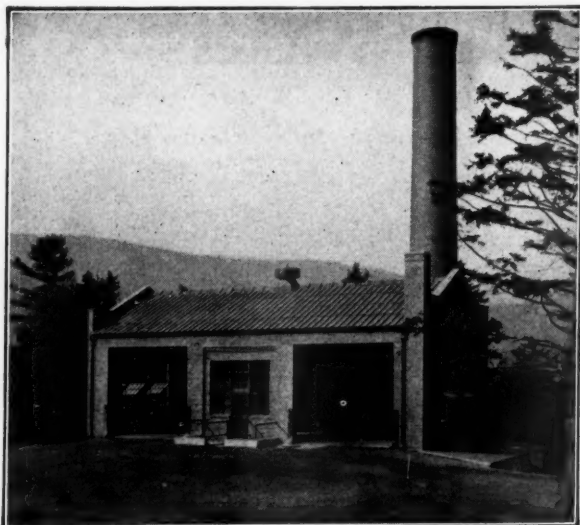
The net available heating value of the combustible materials in rubbish, as received, is $7,257 - (1040 \times 0.558) = 6,677$ B.t.u. per pound. The same method of calculation may be applied to any garbage or rubbish. The net available heating value is the value to be used in all heat balances and computations of boiler efficiencies.

Considering the air required for combustion, he finds that the minimum or theoretical amount at 32°F. and 14.7 lbs. pressure varies, in the case of garbage from 72.51 cu. ft. per pound of material for leanest garbage dry substance to 85.49 cu. ft., averaging 78.51. For rubbish it averages 64.97 for the combustible materials. For mixed refuse 2:1, as received, about 28 cu. ft. per pound is required.

At 1400°F. and 14.22 lb. per sq. in. pressure, the volumes of air are 3.91 times the volumes at normal temperature and pressure; at 1800° the factor is 4.74. In burning wet garbage with rubbish, the amount of air used in practice exceeds these theoretical figures by about 250%. "The moisture is evaporated as steam, a gas, and becomes superheated. The molecules of this non-combustible gas tend to form a separating medium between the molecules of oxygen and those of the combustible gases. Thus moisture increases the opposition to combustion and increases the need and value of assuring a thorough and homogeneous mixture of the gases rising from the fire."

Taking mixed refuse containing 2 parts of garbage to 1 of rubbish, and using average compositions as already given, we have as the properties of the mixture:

	Water	Ash	Non-Combustible	Combustible	Net Available Heating Value, B. t. u. per lb.
	%	%	%	%	
Garbage	48.04	2.41		16.14	1,018
Rubbish	1.47	1.23	12.49	18.11	1,402
Mixture	49.51	3.64	12.49	34.25	2,420
If the garbage be dried and non-combustibles removed from the rubbish, the properties become:					
Garbage		2.41		16.14	1,517
Rubbish	1.47	1.23		18.11	1,402
Mix	1.47	3.64		34.25	2,919
Mix as fired per lb.	3.73	9.25		87.02	7,416



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From the above analysis it is concluded that approximately one-sixth of the net available heating value of mixed refuse is lost for steam generation or other useful purposes when rubbish and garbage are burned in the "as received" state. The effect of water vapor on the gaseous combustion stage and the excess air required for burning wet fuels point to the desirability of drying garbage for fuel purposes. Dried garbage possesses a uniform heating value equivalent to that of the best dry wood fuels. In the dried state the material can be either fed uniformly to a furnace or stored and fed according to power demands.

Essential Features of Sanitary Drinking Fountains

The design of sanitary drinking fountains was the subject of a final report presented by the joint Committee on Plumbing of the American Public Health Association and the Conference of State Sanitary Engineers at the October, 1930 meeting of these organizations. The Committee, of which C. A. Holmquist, director, Division of Sanitation, New York State Department of Health, is a member, agreed upon the ten following as essential to sanitary design:

1. The fountain shall be constructed of impervious material, such as vitreous china, porcelain, enameled cast-iron, other metals, or stoneware.
2. The jet of the fountain shall issue from a nozzle of non-oxidizing, impervious material set at an angle from the vertical. The nozzle and every other opening in the water pipe or conductor leading to the nozzle shall be above the edge of the bowl, so that such nozzle or opening will not be flooded in case a drain from the bowl of the fountain becomes clogged.
3. The end of the nozzle shall be protected by non-oxidizing guards to prevent persons using the fountain from coming into contact with the nozzle.
4. The inclined jet of water issuing from the nozzle shall not touch the guard, thereby causing splattering.
5. The bowl of the fountain shall be so designed and proportioned as to be free from corners which would be difficult to clean or which would collect dirt.
6. The bowl shall be so proportioned as to prevent unnecessary splashing at a point where the jet falls into the bowl.
7. The drain from the fountain shall not have a direct physical connection to a waste pipe unless the drain is trapped.
8. The water supply pipe shall be provided with an adjustable valve fitted with a loose key or an automatic valve permitting the regulation of the rate of flow of water to the fountain so that the valve manipulated by the users of the fountain will merely turn the water on or off.
9. The height of the fountain at the drinking level shall be such as to be most convenient to persons utilizing the fountain. The provision of several step-like elevations to the floor at fountains will permit children of various ages utilizing the fountain.
10. The waste opening and pipe shall be of sufficient size to carry off the water promptly. The opening shall be provided with a strainer.

Disposing of Old Tin Cans

The disposal of tin cans without causing unsightly dumps, encouraging mosquito breeding and attracting insects is difficult; and, for small communities at least, baling for sale is expensive and unprofitable. At the U. S. Veterans' Hospital, Legion, Texas, a brick incinerator has been built lined with firebrick in which an intense heat (2,700°C) is produced by using an oil furnace flat-flame burner, superheated steam being brought into contact with the oil flame. Tin cans and non-salvageable glass bottles are stored in barrels, and these, with the other refuse, are burned once a week in the furnace. Three hundred and twenty pounds of cans can be burned in an hour, the oil used costing 80 cents. The refuse slag is said to make excellent road material.



Photo by Underwood & Underwood

In Kansas City... CAST IRON MAINS of the original water system are still in good condition

From prominent cities in every section of the country come testimonials to cast iron pipe's long life and durability. For instance, Kansas City, Mo. A recent letter from the Kansas City Water Department contains the following excerpt:

"The first cast iron pipe was laid in Kansas City about 1874, when the National Water Works Company was granted a franchise to supply water to the city. Some of this pipe is still in service. The lines that have been removed were laid by the old company and were not removed because of any defects in the pipe but were taken up to be replaced by lines of larger capacity."

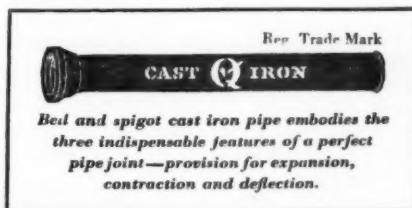
The reason for the long life of cast iron pipe is its effective resistance to rust. Cast iron is the one ferrous

metal for water and gas mains that will not disintegrate from rust. This characteristic makes cast iron pipe the most practical for underground mains, for rust will not destroy it.

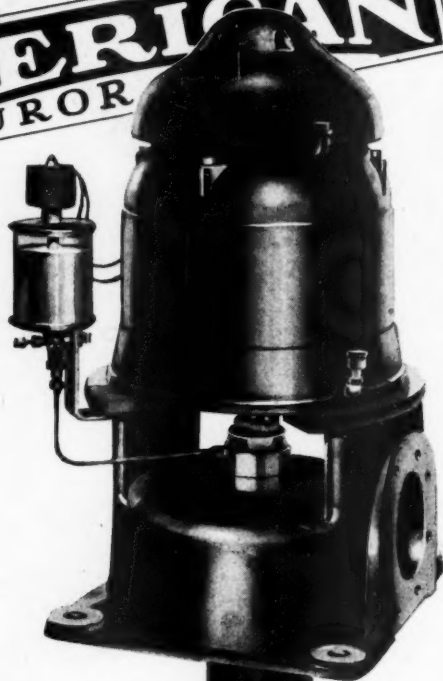
The Cast Iron Pipe Research Association offers to taxpayers, engineers and city officials, detailed information regarding the use of cast iron pipe for gas, water, sewers,

culverts and industrial needs. Address: The Cast Iron Pipe Research Association, Thomas F. Wolfe, Research Engineer, 122 So. Michigan Avenue, Chicago, Ill.

Cast iron pipe bearing the "Q-check" trade mark is obtainable from the following leading pipe founders: Alabama Pipe Company, Anniston, Ala.; American Cast Iron Pipe Company, Birmingham, Ala.; James B. Clow & Sons, 219 N. Talman Avenue, Chicago, Ill.; Donaldson Iron Company, Emaus, Pa.; Glamorgan Pipe and Foundry Company, Lynchburg, Va.; Lynchburg Foundry Company, Lynchburg, Va.; National Cast Iron Pipe Company, Birmingham, Ala.; United States Pipe and Foundry Company, Burlington, N. J.; Warren Foundry and Pipe Company, 11 Broadway, New York.



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The Water Wheel

(Continued from page 63)

testing. This resulted in a considerable reduction of water unaccounted for, including discovery and repair of leaks.

Corrosion⁴³ of the 30" steel Coolgardie main laid 25 years ago from near Perth for a distance inland of 350 miles to serve the Western Australia Goldfields is mainly due to the presence of mill scale on the steel and to defects in the bituminous coating, according to Johnstone-Taylor. Two to five million gallons of water are pumped daily by twenty 300 hp. high duty pumps located in 8 stations.

Anchor ice and frazil²¹ formation at the pumping station inlets have caused considerable trouble at Ogdensburg, N. Y. Many remedies were tried with varying success.

Small cast iron pipe³² is used for irrigating golf courses, for parks and cemeteries, laterals in large filtration plants, and for small mains. It is manufactured best in the horizontal method of casting, according to McWane, in 5'-6' lengths which are factory connected into 18' lengths.

Waterworks management²⁷ can be improved in many ways, states Fenhell, such as by (1) providing for employment strictly according to Civil Service rules free from political interference; (2) establishing a retirement pension fund; (3) maintaining suitable water rates; (4) assigning funds from water collections solely to the water department; and (5) continuing necessary research activities.

The successful waterworks superintendent⁴² not only manages the system satisfactorily, but creates a public interest in it, according to Johnson.

Depreciation²⁸ should be provided for in every financial statement, and according to Supreme Court of the U. S. ruling in the Maryland case, Jan. 6, 1930, the rate base is the present value.

The old employee in industry²⁴ can be provided for after retirement in the best manner, according to Streat, by retirement benefits through a life insurance company. A general plan provides pensions of 50-70 per cent of average wages by purchasing an annuity of 2 per cent of the aggregate of each year's wages. Employees should contribute 3-5 per cent of their wages for such retirement pensions.

The liability of municipalities and private water companies⁴⁶ for injuries to employees and other persons is similar both in degree and extent.

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City Departments Cooperate to Get Things Done

In its annual report for 1930, the Division of Housing and Town Planning of the Dept. of Public Welfare of Massachusetts makes this statement, which is commended to the consideration of all cities, large and small, from Maine to California.

"To get results a planning board must—

- "1. Have ideas. It must conceive things that need to be done. They must be things that will permanently help the town.
- "2. Work out the details, the how and the cost of doing the things needed.
- "3. Do things. To think of things as needed is

not all. To work out all details is but one step. To get the things done is the thing. How to get things done in a democracy is not simple. But until a thing is done there is no accomplishment. Results count.

"As a method of getting things done, a recent step in Stoneham is suggestive. The entire official body came together to consider problems affecting the physical growth of the town. It was not a mere gesture in co-operation. During two and one-half hours of discussion there was not one word of criticism of one department by another, there was no show of interest in political preferment at the expense of the interests of the town. A town with problems to solve, which means all towns, can take no better first step. When all officials work together, it is an easy step to popular support. When the people back a proposal it will be carried out."

Garbage Disposal in Sewage Treatment Plant


By P. E. White, B. S. in San. Eng.

Early in the summer of the year 1923, Dr. C. R. Fox, city chemist, and Wm. S. Davis, city engineer, of Lebanon, Penna., noticed that the sewage arriving at the treatment plant contained some garbage, including cantaloupe and watermelon rinds, and that this material floated on the surface of the Imhoff tanks. If not scooped off, this floating garbage putrefied and gave off offensive odors. They believed that, by separating the garbage into finely divided particles before it entered the tank, the particles would settle and putrefy. Therefore, an experimental plant for grinding the garbage was built. The shredded material was passed through an iron chute into the supply channel of one of the Imhoff tanks, and settled immediately and entered the sludge chamber of the tank. This solved the immediate problem of odors.

However, there were still many questions to be answered: "Would it cause an increase in the amount of sludge?" "Would it affect the drying and the fertilizing value of the sludge?" "Would the action of the tank be harmfully affected?" To answer these questions a nine-months' experiment was started.

During this experiment the garbage was ground by an old lime crusher (a No. 7 shell mill designed for grinding clamshells or dry clay). This crusher consisted of a roll and fixed jaw, the roll having projections and recesses so as to give a shredding effect. The hopper had a 14x14-in. opening at the top and a 4x6-in. opening at the bottom, and was approximately 15 in. deep. The roller was 2½ in. in diameter. With one man feeding the mill, garbage would pass through at the rate of 500 lbs. in 15 min., or a ton an hour. The roll of the crusher was kept from clogging by a ½-in. stream of water from a garden hose passed into the hopper with the garbage. About 4,000 lbs. of garbage was run through this grinder daily. This was about one-sixth of the garbage produced daily by a city of 25,000 people, and hence it was discharged into the east tank of No. 2 Imhoff tank, which constituted about one-sixth of the Imhoff capacity at that time.


Assuming that the amount of garbage from a city of 25,000 is ten to twelve tons daily, of which from



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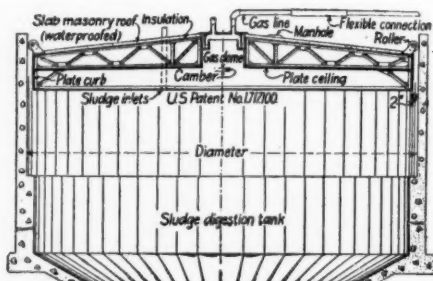
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75 to 80 percent is water, and that the volume of sewage treated at the disposal plant is some 2 m.g.d. or about 8,000 tons daily, of which about 0.2 percent is solids, it can be seen that the total solid matter flowing into the tank is not materially affected by the addition of the garbage. The water is separated from the garbage very quickly and easily when the garbage is ground, fully 75 percent of the water in the garbage being released.

After nine months of experimentation the questions which were raised at the beginning of the period were very satisfactorily answered:

1. The amount of sludge was not materially increased, a change of less than 1/10 of one percent being noted by actual measurements taken of the tanks.

2. The drying period of the sludge was not lengthened. Nor was the fertilizing value of the dried sludge affected, as shown by chemical analyses which were run during the progress of the experiment.

3. The action of the tank was not harmfully affected; in fact, it was improved, there being less foaming than when the tank was working under ordinary conditions.

Following this test, Dr Fox and Mr. Davis took out a patent on the process, which has recently been purchased by A. A. White, Inc., of Lebanon. The results obtained seemed to demonstrate that a plant for a city of 25,000 for the disposal of all the garbage can be housed in a building 40x40 ft. in plan with a concrete floor. The hopper of the grinder should be level with the floor so that the garbage truck can be dumped directly into the grinder. For a grinder, a bone mill can be used with a nominal capacity of 20 tons a day run by a 20-hp. motor. This entire plant can easily be operated by one man.

English Type of Sewage Distributor on a Kentucky Filter

(Continued from page 25)

that a brownish fermenting sewage was coming into the plant. This was traced up through the sewer line by smell until it ceased to be noticeable and a few days later a raid was made on a moonshine still in a house at this point.

The plant is enclosed in a chain link fence and shrubs and roses have been set out to beautify the grounds. The Erler Corporation of Cincinnati were the contractors, and the plant was designed and construction was supervised by the city's engineering department.

Digestion of Raw Sludge Seeded With Ripe Sludge Filtrate

(Continued from page 29)

There was no apparent reason why material seeded with semi-digested sludge digested more slowly than that seeded with raw sludge. The reverse condition is what would be expected and what would normally occur. It is very likely that the semi-digested material used for seeding contained substances which were slow in producing rapid digestion.

It would seem from the experiments that the filtrate from digested sludge could be used for seeding purpose, but certainly the wet sludge itself would be preferable.

The sewage-works is under the supervision of C. F. Goob, chief engineer, and Milton J. Ruark, sewerage engineer.



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HACKENSACK. Illustrated below. This we consider to be the finest tapping sleeve made. Extra long. Requires the minimum amount of lead.

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ILLUSTRATIONS

Above: The Smith Clamped Tapping Sleeve.

Below: The Smith Hackensack Tapping Sleeve.



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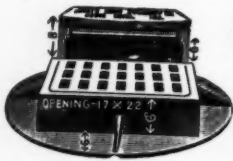
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Prolonging the Life of Scarifier Teeth

A contractor engaged in road construction in Michigan found that, in breaking up an old gravel road with a scarifier, the teeth made of ordinary tool steel ordinarily lasted only about four hours, says "Oxy-Acetylene Tips," before becoming too badly worn to be used further, and then had to be replaced. To remedy this, he hard-faced the teeth with Haynes Stellite, about a half pound to each tooth, covering the tip and the front edge to approximately the point to which the tooth penetrated the road surface. After twenty hours of service, while worn, they were apparently good for another twenty hours. The material was applied by the oxy-acetylene process from a welding rod.

Cattaraugus County Board of Health

In 1929 a revision of the public health law of New York State clarified the degree of responsibility which the county commissioner of health bears toward the protection of public health in the county in regard to sanitary problems. The sanitary engineering work of the county rendered to local communities now forms an integral part of the county health department program. In that year the health department of Cattaraugus County organized a bureau of sanitary engineering, in charge of a trained engineer, which supervises water, milk and food supplies, and sewage disposal and general sanitary conditions. Until this time little sanitation work had been developed in an organized manner in the county except in the city of Olean.

Early in 1930, at the request of the Milbank Memorial Fund, Prof. C. E. A. Winslow of Yale University undertook a survey of the health activities in that county from 1923 to date, and Ira V. Hiscock, Assoc. Prof. of Public Health in the Yale School of Medicine, made an appraisal of the work during 1929 upon the standards of the American Public Health Association.

The reports of these investigators have been made the basis of a report by the county board of health, of which John Walrath is president and N. M. Fuller is sanitary engineer. This shows an unusually active and progressive board and most encouraging progress in bringing the health conditions of the county to a high standard. The budget for 1929 totaled \$107,850, of which \$66,000 was from county and state funds and \$41,850 from the Milbank Memorial Fund.

The report contains several references to matters which are of direct interest to waterworks and sanitary engineers. Two of these are quoted below.

Spring Waters Polluted

By Fertilizer. Gowanda, with a population of 2,673, was served by water obtained from springs and drilled wells 290 feet deep. In March, 1929 there was a rather serious outbreak of enteritis in the village, caused by gross pollution of the springs and reservoir with farm fertilizer which had been washed into the reservoir during a period of extreme run-off. The fertilizer had been spread out on frozen ground above the springs. A chlorinator was placed temporarily on the reservoir pipe line. The village board immediately authorized the construction of a new covered concrete reservoir on the south side of the creek, and now obtains its supply from a new well with sufficient capacity to supply the needs of the entire village.

By Salamanders. Porterville is served by springs and an auxiliary well supply, about 900 of the 1000

population being so served. All of the ten spring enclosures were completely rebuilt and each group surrounded with a strong cyclone fence. In addition, the pipe line to the reservoir has been arranged so that all the water passes through the reservoir, instead of being by-passed as formerly. This permits all material which might settle to deposit in the reservoir, and prevents freezing in winter.

This water was tested some forty-eight times, with twenty-two positive results for B. Coli, in spite of the fact that the isolated nature of the springs makes it nearly impossible for human contamination to occur. The county laboratory made a study of this phenomenon and showed that the free living salamanders present in springs and other ground water supplies give off many organisms into the water which are indistinguishable by ordinary means from colon bacilli of human origin.

Care and Handling of Truck Tires

The following suggestions for getting the greatest possible service out of truck tires are offered by L. W. Fox, sales engineer of the Firestone Tire & Rubber Co.:

Selection of Tires. It is very important that the tire capacity be sufficient to handle the pay load plus the empty vehicle. If the loaded vehicle cannot be weighed, it is possible to obtain the weight of the empty vehicle on each axle and then distribute the pay load according to the following simple formulae:

$$\frac{B \times \text{Pay Load}}{\text{Wheel Base}} = \text{Pay load on front axle}$$

$$\frac{A \times \text{Pay Load}}{\text{Wheel Base}} = \text{Pay load on rear axle}$$

In which B is distance from center of pay load to rear axle and A from center of load to front axle.

There are quite frequently cases of the center of the load being behind the rear axle, which tends to lift the front axle off the ground. Any reduction in front axle load because of such construction is added to the rear axle. This design seems to be quite prevalent in the small panel body trucks and is aggravated by loading toward the rear of the body for convenience.

Usually the front wheel loads do not require the same tire size as used rear. It is usual practice, however, to apply the same size tire front as the rear, thereby providing interchangeability and necessitating but one spare.

Tires should be applied to rims of the size for which they were designed. Rims are purchased once for the life of the truck, and the extra cost of a size larger rim may be paid for many times over through greater tire mileage and less trouble. A tire cramped into a small rim is reduced in air volume and therefore in carrying capacity. In addition, its base is narrowed, causing more side rocking, excessive flexing and possible failure.

It is better to use only heavy-duty tires, although the first cost is greater, for these have heavier beads, carcass and treads, all designed to meet the demands of heavy commercial service.

Care of Tires. This requires organized and scheduled service. Too much stress can not be given to proper inflation; no single phase of service is as large a factor in low tire costs and continuity of service. The

inflation recommendations of the tire manufacturer should be followed. Tires should be inflated at least once a week; in some cases of particularly severe conditions they are checked every trip. Twenty percent under recommended inflation causes a loss of 30 percent in tire mileage as well as possibility of tire trouble due to excessive flexing.

Where dual tires are used it is especially important that the inflation be kept the same in both to avoid one tire carrying more than its share of the load. In some travel over heavily crowned roads it is desirable to carry 10 percent above the recommended inflation in the outside of the dual tires to equalize the tire loads. This, however, should not be done unless the wear of the inside tires indicates its necessity.

Proper mating of tires also is important for equalizing loading; new tires should not be mated with completely worn ones because of the difference in over-all diameter. If new and partially worn tires are mated the latter should be placed on the inside.

Changing position of tires may prove very beneficial. Particularly in delivery service, curb chafing may result in tire failure, to prevent which the tires may be reversed before the side has been badly scuffed. But this should be prevented by education of the drivers, which education should also include fast driving, quick acceleration, severe braking, fast corner-turning, etc. A driver who is hard on tires is hard on the vehicle in all ways.

Mechanical adjustments are, of course, important and should be checked according to a schedule. Alignment of front wheels is particularly important in delivery service because of the tendency to get out of adjustment through curb shock. Smooth and efficient brakes not only insure longer tire mileage, but are a safety factor that no operator can afford to overlook. Wobbly wheels, loose bearings, rear axle alignment, etc., while not prevalent, are encountered at times and should be corrected.

Scheduled inspection of tires may reveal injuries that can be repaired economically and insure longer tire life.

Low Guard Rails on South Carolina Roads

THE South Carolina Highway Department has designed and uses a wooden guard rail which differs from the ordinary rail, in that no post can be struck directly by an automobile, but the blow is delivered by the hub on a 3" x 10" timber guard rail supported with its lower edge only 10 inches above the subgrade. This rail is fastened to the inside face of posts 6' 2" long, set with only 24" above the ground, with their tops chamfered 30° with the horizontal. On the chamfered tops is set a top rail 2" x 10", with its lower edge flush with the top edge of the main rail. The rails are 16' long and the posts are spaced 8' centers, the main and top rail joints coming on alternate posts. The main rail is fastened to each post with three 60 d spikes, for which holes are bored to prevent splitting. The top rail is attached to each post with two 40 d spikes, and to the main rail with 40 d spikes spaced 2' centers.

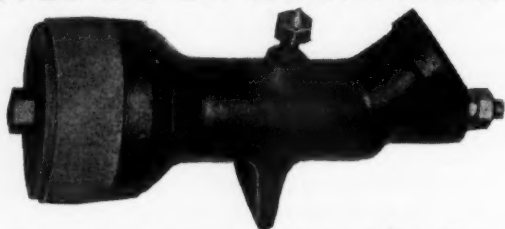
The posts, two-thirds of which are buried in the ground, are treated with 12 lbs. of creosote per cubic foot by an empty-cell process, and the rails are treated with 1 lb. of zinc chloride.

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Cost of Oil-Gravel Surfaces in North Dakota

Oil-gravel mixed surfacings were first constructed in North Dakota in 1929. To date the mixed-on-the-road method has been employed almost exclusively, except for a 5-mile project near Minot completed late last fall, in which the material was premixed in a standard asphalt paving plant which was located there.

On oil-gravel projects for which complete data are available, the aggregate cost from 88 cts. to \$1.597 per cubic yard, averaging \$1.197; the oil cost \$1.125 to \$1.551, averaging \$1.32 per cubic yard; the processing cost 62.1 cts. to \$1.20, averaging 80.7 cts. The total cost averaged \$3.329 per cubic yard. The surfacing averaged 1,000 to 1,250 cubic yards per mile and the cost about \$3,400 a mile; or \$3,542 including oiling of shoulders.

The report of this work given by the highway commission says:

"On the work done by the road mix method we have used equipment owned and operated by the department. This consists of a 20-horse power steam boiler mounted on an old truck chassis; a 1,000-gallon pressure distributor mounted on a 5-ton truck; one 3-ton utility truck; one caterpillar 20 for pulling the spring tooth and disc harrows; four 10-20 power patrols, and one 15-30 power patrol.

In arriving at the cost of processing, the following rental charges are made for the equipment:

Steam boiler	\$4.00 per hour
5 Ton truck	3.00 per hour
3 Ton truck	2.50 per hour
Distributor	2.00 per hour
Caterpillar & discs	1.50 per hour
10-20 power patrols	1.75 per hour
15-30 power patrols	2.50 per hour

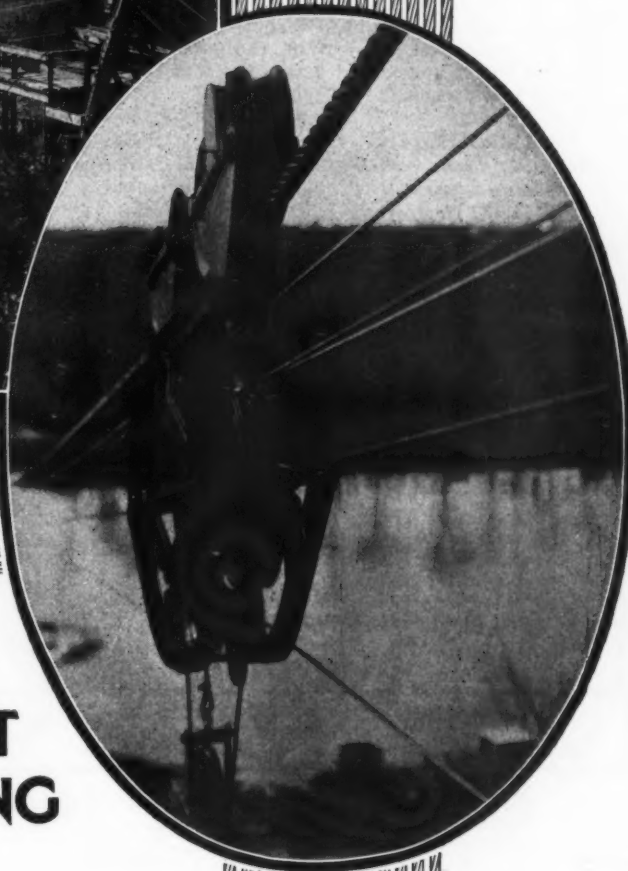
These hourly rental rates cover interest on investment, depreciation, operator's salary, gas, oil, repairs, coal and water for the boiler, etc. A night and a day man are necessary on the boiler, but only one half of the total hours are billed for at this rate. These rates may appear high, but time lost due to rain, and the shortness of the season, make overhead and interest charges higher than on the usual kinds of work."

Government Requires Progress Photographs of Contract Work

Specifications for work to be done in 1931 for the War Department in repairing two government dredges contain the following provision:

Photographs.—After work has been started, suitable photographs shall be taken on the first of each month, or as soon thereafter as practicable. Sufficient views shall be taken to show clearly the rate of progress of the work. Photographs shall be 8" x 10" in size, mounted on linen with a 1" margin for binding, and shall be first-class in every particular. Upon completion of the repairs and just prior to the delivery, a broadside photograph shall be taken. Two copies of each view shall be furnished to the contracting officer as soon as practicable after being taken. Each photograph shall contain upon its face the date and necessary title.

The advantage of taking photographs of construction work has frequently been set forth in PUBLIC WORKS and the practice recommended to engineers. There are certain advantages in having the photographs taken by the engineer representing the public rather than by the contractor; the taking of photographs by both would be best, we believe.



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*The Smart Way is the Suite Way
Weekly or monthly rates if desired*

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Building an Indiana Road Across Muck Beds

In building a 20-foot concrete road between East Gary, Indiana, and a point 7½ miles east, the contractor, the Calumet Paving Co. of Gary, encountered a difficult filling job. There was 76,500 cubic yards of excavation in the contract of which 3,500 was special borrow; but three muck beds over which the road ran required 15,000 cubic yards additional fill.

The first of these was 1,300 feet long and had an average depth of 5 feet. The muck was dug out with a clamshell (a "Northwest" was used) and backfilled with sand and gravel from a nearby pit. The second bed was 14 feet deep, and dynamite was used to settle it and it was then filled to 6 feet above grade. After three weeks of settling, the overburden was leveled off.

The third bed averaged 30 feet deep, and two shovels had to be used to furnish material for the fill, and 16 one-yard dump cars to handle it rapidly enough to keep ahead of the sinking.

Difficulties of Work at High Altitude

THE road leading from Denver to the top of Mount Evans, one of the highest peaks in the state, known as the Mount Evans Road, is said to reach the highest altitude of any in this country—14,106 feet. The road has been under construction for several years past, a section being built each year, and it is hoped to have it finished this year.

Much of the delay in construction has been due to the atmospheric conditions. Comparatively few men can work in the rarefied air found at this altitude. The temperature is low, especially at night, even in mid-summer. Snow falls almost daily during July and August. The workmen suffer from cold, although their base camp is 2,000 feet lower in altitude than the summit and four miles from it. Alcohol is used all the year in the radiators of the gasoline shovels, trucks and other engines. The illustration shows an excavator and truck working at an elevation of 14,000 feet for the contractor, W. W. Giggey & Co. of Boulder, Colo.



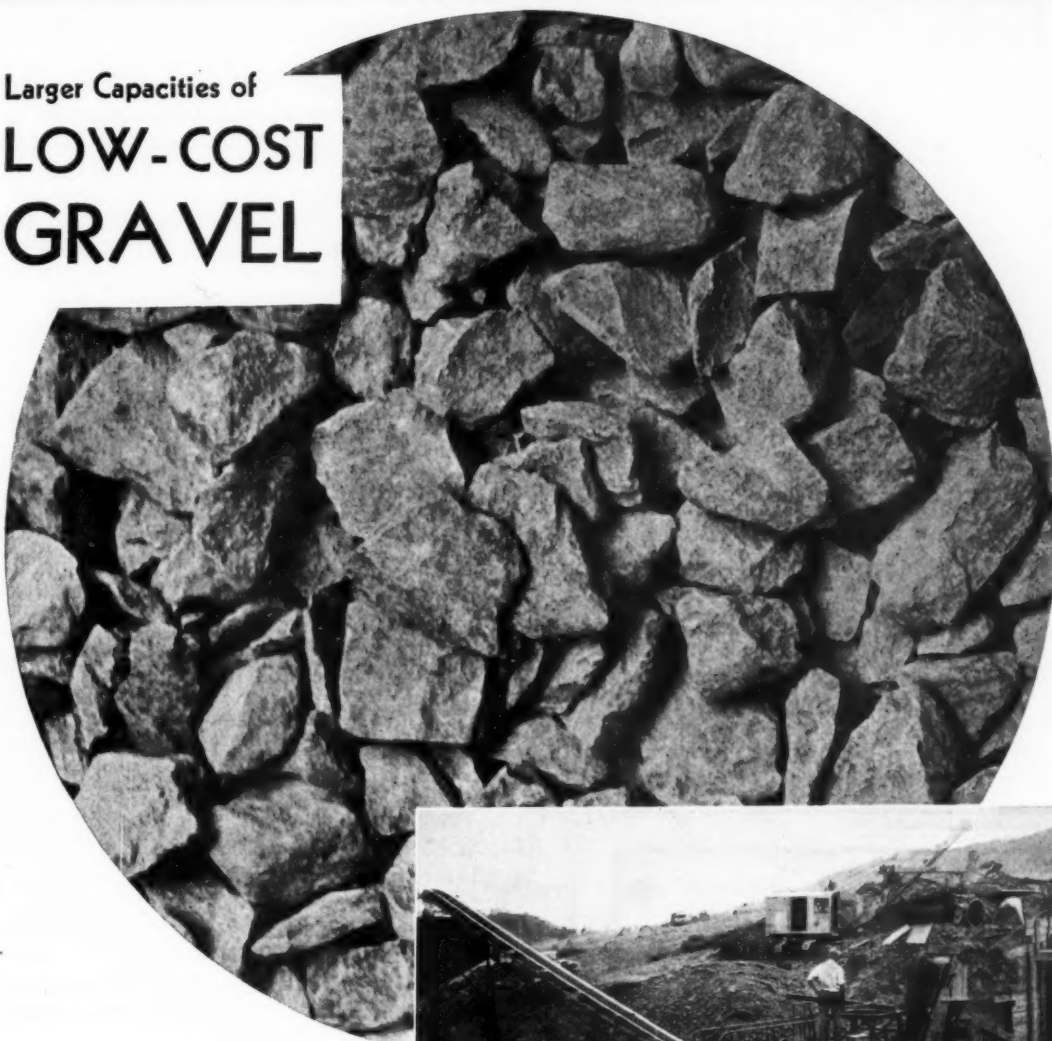
Road construction at 14,000 feet elevation.

Electrical storms are frequent here, and to reduce the hazard to the men, metal buttons on the workmen's clothing were replaced with non-metallic buttons, and those who were liable to touch metal during their work were obliged to wear gloves.

For this information we are obliged to F. B. Morrison, of the General Excavator Co., maker of the excavator shown.

PIONEER GRAVEL EQUIPMENT

Larger Capacities of
**LOW-COST
GRAVEL**



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There are 11 sizes of Pioneer Screening, Crushing and Loading Plants, also drag-lines, conveyors, revolving screens, etc., also Washing Plants.

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Portable Screening, Crushing and Loading Plant. The Duplex was designed to meet the need for a portable plant with larger capacities where specifications require reductions of 1 inch, $\frac{3}{4}$ inch or $\frac{1}{2}$ inch minus.

This picture shows one of these plants in operation. It is producing better than 65 cubic yards per hour from ledge rock. Pioneer 21-yd. portable steel storage bin is in left background.

Pioneer Gravel Equipment Manufacturing Company
1515 Central Avenue Minneapolis, Minnesota

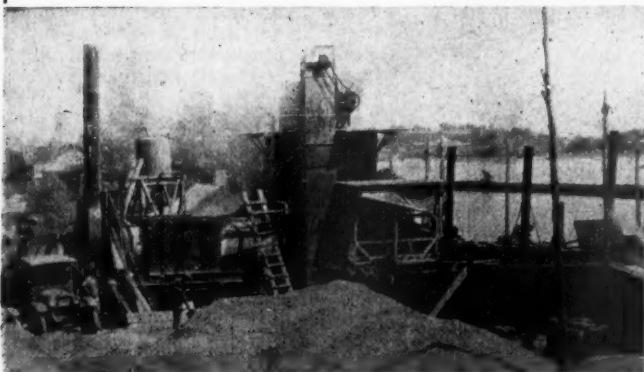
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This "Domestic" Triplex Pump has among its many superior features:

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What a Municipal Report Should Contain and Be

Twenty criteria of an ideal annual report, as established by Dr. Clarence E. Ridley.

For four years past Clarence E. Ridley, of the University of Chicago, has been examining and appraising municipal reports and grading them on the basis of twenty criteria which he set up for this purpose. He assigns a value of 5 as perfection for each item, wherefore perfection in each of the twenty would give 100 as a perfect score. Promptness of publication has a total count of 5; physical make-up, with four items, has a possible 20 points; content accounts for the other 75 points.

His ideal is defined under the several criteria as follows::

1. The report should be published as soon as possible after the end of the period covered—six weeks as a maximum.

Physical Make-up

2. The size should be convenient for reading; preferably 6 x 9.

3. The paper should be of such grade and the type of such size and character as to be read easily.

4. The more important facts should be emphasized by change of type or by artistic presentation.

5. The cover, title, introduction and general appearance should aim to attract the reader and encourage further examination.

Content

6. To insure an accurate and effective presentation of diagrams and charts, established rules should be followed.

7. A few well-chosen maps to indicate certain improvements, and a liberal supply of pictures pertinent to the report should be included.

8. Great care should be exercised in placing the illustrative material contiguous to the relevant reading matter.

9. A short table of contents in the front of the report is a great aid for ready reference.

10. An organization chart or table indicating the services rendered by each unit, if placed in the front of the report, will help the reader to a clearer understanding of what follows.

11. A short letter of transmittal, which either contains or is followed by a summary of outstanding accomplishments and recommendations for the future, should open the report.

12. A comparison of past recommendations with the progress toward their execution will serve as an index to the year's achievements.

13. Fifty pages should be the maximum length.

14. The text should be clear and concise, reflecting proper attention to grammar, sentence structure and diction.

15. The report of the various governmental units should correlate with the organization structure or follow some other logical arrangement.

16. The material should show a complete picture, and each activity should occupy space in proportion to its relative importance.

17. Certain statistics must be included, but, wherever appropriate, they should be supplemented by simple diagrams or charts.

18. The present year's accomplishments should be

A Veteran Driver Speaks His Mind

A letter to The Chicago Tribune, reproduced below, prompts this advertisement. Straight-forward, earnest and dramatic, the letter comes like a warning voice out of everyday traffic.



HAPPY IS THE DRIVER WHO DRIVES AN INTERNATIONAL

THIS letter, which is reprinted from the "Voice of the Traffic" column of The Chicago Tribune, sounds a note to which every owner of motor trucks and truck fleets should give heed.

Do your trucks deserve to haul your loads? Or are there antiquated models among them, hazardous to life and limb, destructive to driver-morale, and raising costly hob with your profit opportunities? Turn the obsolete trucks out to pasture and invest in efficient new equipment.

*There is a bright side to the veteran driver's letter. He admires the great modern fleet of Tribune trucks. This fleet, serving the Tribune organization, and used in the distribution of The Chicago Tribune, The New York Daily News, and Liberty, now numbers

over 200 trucks, and all of them are Internationals.

The full line of Internationals—Speed Trucks and Heavy-Duty Trucks of new design—is ready for inspection at 182 Company-owned branches in the United States and Canada. Sizes from $\frac{3}{4}$ -ton to 5-ton. Demonstration will be arranged at your request.



Above is one of the trucks this driver compliments so highly in his letter—it is one of The Chicago Tribune's large fleet of Internationals.

To the Chicago Tribune:

"I see that the Cook county police are beginning a drive against noisy trucks. Being a truck driver I believe that the authorities are taking the wrong course in warning drivers to make repairs.

The large cartage companies do not listen to the drivers' complaints, or else it is because our foremen do not inform the owners. Daily we are forced to take out patched up 10 and 15 and even 20-year old trucks, with faulty brakes, hard to shift, and still harder to steer.

As for loads, I have put a monster load of canned goods on one truck and hauled it through the city, praying all the time that no other vehicle would cut me off too close. Going at a speed of 10 miles an hour, I required 80 feet to stop, using both sets of brakes.

The speed governors on our trucks are all 'out of order,' and we are laid off if we do not make good time. It is the same if our chariots break down too often or if we have an accident, no matter how slight. It is only because we are expert drivers that we get by. I believe it really criminal to force men to drive some of the wrecks that are on the streets today.

*I notice (enviously, too) that the Tribune always has an up-to-date fleet of trucks, and I have yet to see one of them broken down on the street or in a serious accident."

A Truck Driver

INTERNATIONAL HARVESTER COMPANY
606 So. Michigan Ave. OF AMERICA Chicago, Illinois
(INCORPORATED)

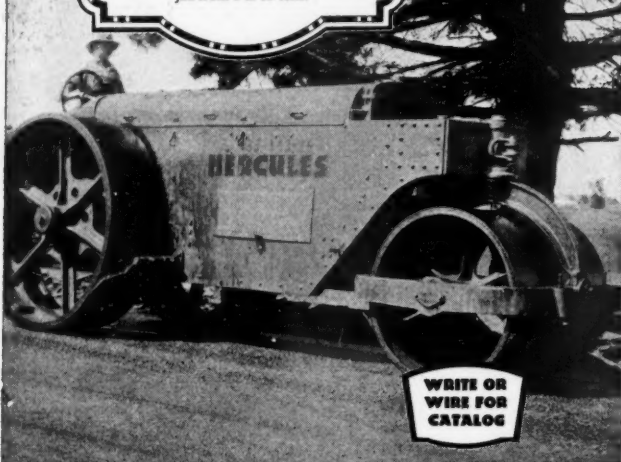


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HERCULES ROLLERS

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A Hercules Roller on any road job will complete the work in record time—an outstanding performer that forces a real profit out of every contract. Hercules is preferred by road contractors everywhere, who appreciate its tremendous power, unusual speed, easy handling, and unmatched strength for severe service. There is a Hercules model for every job from 6 to 15 tons.



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Every room in the Morrison Hotel is an outside room, with bath, circulating ice water, bed-head reading lamp and Servidor. A housekeeper is stationed on each floor.

The Morrison is the World's Tallest Hotel—46 Stories High.

Nearest Hotel in the City to stores, Offices, Theatres and Railroad Stations.

CHICAGO'S MORRISON HOTEL

Corner Madison and Clark Streets

**2500 Rooms
\$2.50 Up**

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compared with those of previous years, but only with full consideration of all factors involved.

19. Three or four financial statements should be included, showing amount expended and the means of financing each function and organization unit.

20. It is unethical and in poor taste to include material for departmental or personal aggrandizement. Photographs of officials, especially of administrators, seem out of place in a public report.

Of the sixteen reports examined last year, the average promptness was 4.1 months—nearly three times Dr. Ridley's time limit. In physical make-up the average score was 86 per cent of the ideal—item 4 being graded lower than any of the others.

Other details of these sixteen reports will be found in Dr. Ridley's article in the January issue of the "National Municipal Review," in which he has tabulated his ratings.

Economic Development of Secondary Highways

(Continued from page 36)

well defined, should be surfaced to take care of such traffic, with reasonable provision against future increase; but all other roads should be improved only in accordance with present-day traffic, but with a view to stage development as the future may require.

4. The adoption of a single type of surface arbitrarily over an entire area, regardless of local conditions and materials, is wrong, and such a policy will defeat the end sought.

5. The great outpouring of public funds in the way of bond issues is reaching its peak, and that easy, "painless" gasoline tax is also reaching such limits as to bring protest, all of which points to the necessity for so planning further developments as to come within current revenues.

6. The improvement in the motor vehicle, notably the pneumatic balloon tire, has had a marked effect on the design requirements for highway surfaces, and cost data obtained from tests made several years ago with hard and solid tires is of comparatively little value today.

7. Highway design should primarily emphasize drainage, width, alignment, grade, and surfacing in the order named. Drainage cannot be over estimated, for in spite of all that has been said and written, this important factor is continually overlooked, and roads have failed unnecessarily because of lack of attention in this respect. Width is placed second, because width, properly proportioned to traffic, eliminates concentration of loading and allows sufficient lateral dispersion so that thinner surfacing will be effective which would not be the case if all vehicles ran in the same track. Alignment is more important than grade, and by rolling the grade within proper vertical curve limits as to visibility, more economical earth work can be accomplished, and also easier drainage. It is believed that in many instances, too much money has been spent in obtaining one per cent to four per cent grades, when short sections of steeper grades would have been equally effective, as present day high powered machines are not adversely affected by such design. If all the foregoing requirements are properly met, the last item, that of surfacing,—becomes much simpler and cheaper.

8. Single lane pavements are to be avoided as dangerous.

9. Taking into consideration the fundamentals outlined, it is believed that a very large per cent of the total mileage of highways in the United States can be improved most economically and satisfactorily with bituminous surfaces. It is further believed that this mileage can be improved largely with the low-cost types, and that while certain high types of construction will of necessity continue on a considerable mileage, the one outstanding field of endeavor will be found in providing surfaces to cost around \$5,000 per mile. The bituminous types are the only ones which lend themselves satisfactorily to this price range and, at the same time, provide wide and safe travelled ways. Furthermore, in the event of substantial traffic increase, it is easy to provide for it, by placing a wearing course of bituminous macadam or bituminous concrete.

"For years the design of surfaces was made with a view to obtaining a thickness which would take care

of the worst condition, and then arbitrarily to carry it through the entire length of the project, without regard to the varying subgrade conditions. It is advanced that the correct method of design is to grade and drain a proper roadway width, and then to stabilize the surface through cumulative additions of crushed stone, slag or gravel, to such depths as are required. This may be eight inches at one point and but two inches at another, thereby utilizing to the fullest extent the inherent subgrade values. Such practice produces uniformity of surface capacity, a characteristic of the greatest importance, because all subsequent stage development of the surface then can be estimated accurately and economical provision made for the growth of traffic."

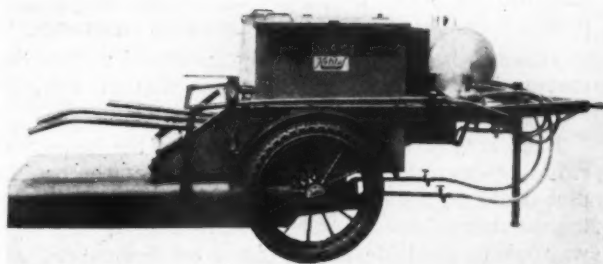
The author then described the various bituminous surfacings which have proved successful, all of which PUBLIC WORKS has described from time to time during the past two or three years. He classifies them as follows:

1. Treatment of natural subgrades. Two classes—on clay soil and on sandy.
2. Surface treatments. Two groups—well-bonded surfaces, and materials which do not bond well.
3. Mixed-in place surfaces. Two groups—Fine aggregate type and coarse aggregate type.
4. Plant mix surfaces.

"There is needed a different attitude of mind on the part of some road builders, who look upon low-cost surfaces as merely temporary expedients. The method which will produce good service at the lowest cost per vehicle per year is the one to use. If one road surface costs \$20,000 a mile and \$200 in annual maintenance, with a traffic of 500 vehicles daily, the cost per vehicle is \$3.60 per year. If a low cost surface requires \$5,000 a mile with \$500 maintenance, the cost per vehicle is \$1.80 per year and, in addition, the surface is becoming continually better. Lest anyone think that \$500 per year is an inadequate maintenance figure for the low-cost types, let it be said that surface treatments seven years old frequently are found, and that a three to five years' interval is common. *A low cost surface is just as much a fixed and permanent part of a properly developed highway transportation system as the most costly type that has ever been devised.*

With the greater use of low cost bituminous surfaces, there is coming a more rapid development of mechanical equipment for handling the operations. Within the near future it will be possible to place surfaces with premixed stone and bitumen, or surface treatments of various kinds, upon stabilized subgrades of one kind and another, both new and old, at rates of one, two and three miles per day of finished road surface, built under traffic, and at costs which will be within the reach of every pocketbook. At such rates of operation it will be possible to let to contract single projects of from twenty to one hundred miles in length, thus affording a more attractive field to contractors, utilizing modern equipment, scheduling shipments, handling aggregates by conveyor, with machine spreading and finishing on the road surface, and with almost over-night transformation of dusty or muddy roads, into smooth, non-skid highways. Does it sound like a fairy story? Perhaps, but the cold, hard arithmetic of the situation makes such construction the only way, if there is to be obtained a real highway transportation system in this country, before the youngest schoolboy now in the first grade becomes a graybeard of ninety."

Consider these Advantages



Hotstuf
TRADE MARK

Combination Tool, Asphalt and Surface Heater



THE IDEAL EQUIPMENT FOR LAYING
NEW and PATCHING OLD ASPHALT
PAVEMENTS

THE HOTSTUF 3 in 1 Combination Tool, Asphalt and Surface Heater may be purchased and used in separate units or in all three units. The Tool Heater will heat seventeen paving tools in five minutes from a cold start. The Asphalt Heater will melt approximately 4000 pounds of asphalt in eight hours, flowing at this rate fifteen minutes after lighting the torches. The Surface Heater saves the time and labor of the old way of chiseling out patches.

These efficient equipments are mounted on a single chassis of channel iron frame, half elliptic springs, rubber tires and roller bearing wheels, and can be trailed at truck speeds.

Write for complete description and prices

Mohawk Asphalt Heater Co.

SCHENECTADY, N. Y.

When writing, please mention PUBLIC WORKS

Roadside Clearing on California's State Highways*

THE roadside clearing program of the Division of Highways paid big dividends to the State of California this year. It was instrumental in preventing scores of fires in the state and in saving property owners many thousands of dollars in potential property damage to forests, grain fields and range.

This has been determined by means of a statewide survey just completed by the Division of Forestry through its rangers in all parts of the state.

Each ranger was requested to relate the benefits of roadside clearing in his particular district, the benefits that could be derived if other areas were cleared up, the number of fires that have started along the highway where roadside clearing has not been done, and the number of fires started where it has been done.

The replies were very enlightening. In 22 out of the 28 counties reporting there had not been a single fire this year along highways that had been cleared. In the remaining five counties there had been only seven fires along highways that had been burned. In the counties reporting, a total of 89 fires swept over land adjoining highways that had not been cleared.

To estimate the fire damage prevented by this method in dollars and cents would be an impossibility. But it is sufficient to say that the property saved was worth many, many times more than the state outlay involved in clearing the highways.

The writer can remember only a few years ago when California's State Highway Commission refused to do any roadside burning, on the ground that if a fire should get away from a crew the state didn't want to be held responsible for any damage it might do.

The present system of obtaining the consent of the owner before any burning is done along his property has proved to be a protection both to the state and to the owner.

Virtually all roadside fires are caused by cigarettes or matches carelessly tossed out of automobiles by motorists or their passengers. The roadside clearing program has nearly eliminated fires from this cause. It has also made it much safer and more convenient for campers to park their cars along the roadside for lunch. In Colusa county, ranger Charles D. Wilcher says the clearing of roadsides "is keeping down the star thistle, which is fast becoming a nuisance to crops in this valley."

Before the roadside clearing in San Bernardino county, there was approximately one fire to every 10 miles of highway in grass land, ranger A. T. Sharp reported. This year there has not been a single fire in that county where the highway was properly cleared, and this includes the Waterman canyon road, where more than 100,000 cars travel annually.

"One of the Motor Transit trucks was completely destroyed by fire," Sharp wrote, "on the Waterman Canyon road. This was within a high brush-covered area and no fire equipment was handy. Due to the clearing along the highway the fire did not escape. Without the clearing it would have spread into the brush and caused considerable damage to the watershed."

Out of a total of 111 fires in El Dorado county, only one was started along state highways that were cleared, according to ranger W. C. Austin.

Another outstanding example of the effectiveness of this clearing work may be found in Kern county, on the Bakersfield-to-Tehachapi lateral. In 1928 there were at least 12 roadside fires on this highway, reported ranger Harold P. Bowhay. In 1929 and 1930 the road was cleared, and thus far this year there has not been one fire reported.

How the giant redwoods along the famous Redwood highway have been protected from destruction was told briefly by ranger A. A. Wilkie of Sonoma county, who said: "Clearing that has been done on the Redwood highway in this county has held the fires down 100 per cent."

NEED FOR SNAG REMOVAL

Dead trees and snags present another problem in highway clearing that deserves careful attention of everyone concerned, because they constitute not only a traffic hazard, but also an extremely dangerous fire menace.

There are some 2836 snags, by actual count, in Highway District Two. It would cost approximately \$20,000 to dispose of the snags in this district, and an additional \$30,000 to clean up slash and other debris in connection with this snag disposal along the highway.

The condition in the rest of California in the timbered areas is very similar to that of District Two. Although great strides are being made in cleaning up the highways, I am convinced that this is a phase of the work that should be given early attention.

Hand Work to Aid Unemployment Is Expensive

The city manager of Niagara Falls, N. Y., W. D. Robbins is reported to have said that sewer bids opened January 16 indicate that the plan of the city authorities to aid the unemployment situation by having the work done by manual labor was impracticable for large jobs because of the much greater cost. The smaller jobs, however, are usually done by hand anyway. On one job, the low hand labor bid was \$27,503.30, while that based on machine construction was \$21,594. On a small sewer job, however, the bids were \$375.06 for hand labor and \$411.65 by machine.

Monessen, Pa., with 20,000 population, about the first of the year began building storm sewers and repairing streets using hand labor throughout to give work to the unemployed. More than 400 men applied for work and the street commissioner had them divided into groups of 35 each, a new group to start every other day until all the men have been used. It is expected that this will make the work cost much more and take a longer time than if done by regular gangs and equipment.

Referring to this method of relieving unemployment, the "Patriot Ledger," of Quincy, Mass., says that a city adopting it "increases the cost of the work, sanctions an economic waste, and degrades its workers. The plain truth is that by this action it adopts the English dole system except for a thin camouflage."

*Abstract from an article by M. B. Pratt, State Forester, in the Official Journal of the California Department of Public Works.

Materials and Equipment Catalogs

Equipment for Contractors.—A new publication giving quick reference data on compressors and related tools. Free copy may be obtained from Chicago Pneumatic Tool Co., 6 East 44th St., New York.

Elevating Graders.—Western Wheeled Scraper Co., Aurora, Ill., has issued Bulletin W-31-B, describing their new No. 6 Elevating Grader. This machine has loaded 17,800 yards in 60 hours. There are many interesting details of design. Folder from Public Works or from the manufacturers on request.

Rotary Fresnos.—Western rotary fresnos of all sizes are described in Bulletin W-31-A, of the Western Wheeled Scraper Co., Aurora, Ill.

Sand Spreader.—The Good Roads Machinery Co., Kennett Square, Pa., have issued a 4-page booklet describing the Good Roads Sand Spreader, which is suited to a wide variety of uses.

Caterpillar Road Building Machines.—The Caterpillar Tractor Co., Peoria, Ill., has issued a beautifully arranged catalog full of information on road building machinery.

Regular Road Maintenance.—The necessity and value of regular road maintenance is stressed in a folder issued by W. A. Riddell Co., Bucyrus, Ohio.

Snow Plows.—Snow plows for Ford and Chevrolet trucks are manufactured by Western Wheeled Scraper Co., Aurora, Ill. Ask for Bulletin W-31D.

Power Shovels.—Bulletin 33—Pocket Dictionary of Power Shovels and Cranes, illustrating with specifications, six Bay City Models of convertible power shovels, cranes and excavators ranging from $\frac{3}{8}$ to one cubic yard capacity.

Power Shovel.—Catalog RS-4—20 pages and cover. Complete specifications and data, covering Bay City full revolving Model R, $\frac{3}{4}$ -yard shovel, 12 ton crane; and Model S, one-yard shovel and $17\frac{1}{2}$ ton crane, with convertible attachments and full crawler mounting.

Power Shovel.—Bucyrus-Erie Co., South Milwaukee, Wisc., has published FBE-431 describing the new one-and-one-half, one-and-three-fourths-yard machine recently announced. This machine, available as either shovel, dragline, clamshell or lifting crane may be driven by gasoline, Diesel or electric power.

Iron Plate Specifications.—The American Rolling Mill Co., Middle-

town, Ohio, has issued a folder covering iron plate specifications for Armco Ingot iron plates.

Silent and Roller Chains.—The Union Chain & Mfg. Co. of Sandusky, O. has just issued a new 124-page Catalog on Silent and Roller Chain of its manufacture. The catalog is complete in every respect, containing not only complete data on these types of chain, but also engineering data of practical value to chain users in figuring chain drives. It also contains complete information and engineering data on sprockets used in conjunction with silent and roller chain drives, and on chain attachments for special purposes.

Use the Coupon on Page 99
if You Want Any of These.

Brown Electric Tachometers.—The Brown Instrument Co., Philadelphia, has issued their new catalog, No. 46, which describes and illustrates Brown indicating and recording tachometers in various models, together with the electric generators used in operating them. There are also illustrations and data covering applications of the equipment. Copies will be sent on request. Use the form on Page 132.

Metal Protective Paints.—The Sherwin-Williams Co., Cleveland, Ohio, has published a most complete 28-page booklet on metal protective finishes. After a general outline, the subjects covered include: Composite paints; boiled linseed oil; combination carbon paints; charcoal carbon paints; graphite carbon paints; red lead paints; problems of the petroleum industry; special acid-fume resisting paint; superheated surfaces; underground piping; oil and gasoline resisting coatings; preparation of metal surfaces for painting; and specification. This complete and valuable text is worth a place in any engineering library. Use the form on page 99.

Water Tube Boilers.—Catalog 98, published by the Murray Iron Works Co., Burlington, Iowa, illustrates and describes the Type "A" water tube boiler and gives much information of interest to engineers.

Condensate Pumps.—Two bulletins have recently been issued by the South Philadelphia Works of the Westinghouse Electric & Manufacturing Company covering their single-stage and two-stage condensate pumps. These leaflets, identified as L-20426 and L-20447 respectively, cover both motor-driven and turbine-driven condensate pumps, and contain characteristic curves showing the effect of submergence to the capacity of the pumps.

Hose and Belting.—A new catalog of belting, packing, hose, matting and miscellaneous items manufactured by The Diamond Rubber Co., Inc. of Akron, Ohio, for industrial use has been published. An interesting feature of the publication is that the cover and mailing envelope were printed from rubber engravings, hand-cut from sheet rubber manufactured by the Diamond company.

Pipe Lines.—Caterpillar Tractor Co., Peoria, Ill., has just issued a new booklet, Pipe Lines, which will be sent free on application.

Deep Well Pumps.—Worthington Pump & Machinery Corp., Harrison, N. J., has issued a 32-page booklet on deep well pumps.

Hydro-Tite Pipe Joints.—The Hydraulic Development Corp., 50 Church St., N. Y., has issued a 32-page booklet full of valuable information for anyone interested in making cast iron water pipe joints in pipe lines. Copy on request.

Chlorinators.—The Paradon Manufacturing Company, Arlington, N. J., has issued a new Bulletin No. 21-A describing Paradon dry feed chlorinators. These units are made in various sizes, from a capacity of .03 of a pound of chlorine per 24 hours up to 300 lbs. of chlorine per 24 hours.

Water Softening for the Home.—By Linden J. Murphy. 18 pages. Ill. Bulletin 105, Engineering Extension Service, Iowa State College, Ames, Ia.

A brief booklet telling what water softening is, the comparative merits of the different softening processes, the costs of water softening, and points to be considered in selecting a home water softener.

New "Douglas Fir Use Book."—A new and practical book for the use of architects and engineers in designing with structural Douglas fir has just been published by the West Coast Lumbermen's Association and is now available for distribution. Its title is "Douglas Fir Use Book." The book contains design tables and supporting technical data which enable a designer to figure loads and specify sizes of Douglas fir for a structure easily and with assurance. The price of the book is \$1.00 per copy. It may be obtained from the West Coast Lumbermen's Association, 364 Stuart Building, Seattle, Washington. The new book supercedes the "Structural Timber Handbook on Pacific Coast Woods," published by the Association in 1916, and which has been out of print for a number of years. It contains a number of valuable features not in the old handbook.

NEWS FROM THE DISTRIBUTING FIELD

The Aeroil Burner Company, Inc., with factory at West New York, New Jersey, and Branch Offices at Chicago and San Francisco, announces the appointment of Herbert M. Orschel as Field Sales Manager.

M. A. Lippman, Assoc. M. Am. Soc. C. E., and former instructor in Civil Engineering at the Polytechnic Institute of Brooklyn, New York, was appointed representative of the Kentucky Rock Asphalt Company in New York, New Jersey and New England, and has established offices at 11 West 42nd Street, New York City.

W. A. Kohlhoff has been appointed sales engineer of the Hydrauger Corporation, Ltd., according to announcement from the headquarters of the corporation in San Francisco. He has been in the gas engineering department of the Pacific Gas & Electric Company for the past ten years, having been with the Coast Valleys Division of that company before taking up his new work. Mr. Kohlhoff has also served in the North Bay and the San Francisco divisions of the Pacific Gas & Electric Company. His engineering training was received at the University of California.

It is reported that E. C. Gledhill, formerly with the Galion Iron Works and Mfg. Co. and later with the Rome Mfg. Co., Rome, N. Y., and some well known Galion men have incorporated a company with an authorized capital of \$300,000—3,000 shares of common stock, par value of \$100 each—and have secured an option on a tract of land on U. S. Route 30 on the Big Four & Erie R. R. just west of Galion, where they plan to put up first a building 300' x 90'. It is stated that Mr. Gledhill has had over 30 years of experience in selling road machinery and a share in the designing of a number of different pieces of road machinery. The new company intends at first to make a line of road graders and later a complete line of road machinery.

Appointment of D. C. Prince as engineer of the switchgear department of the General Electric Company at Philadelphia is effective as of February 12.

The Universal Crusher Company of Cedar Rapids, Iowa, manufacturers of stone and gravel crushers, are making a change in their distribution policy. All equipment sales will now be handled direct with the user or through local jobbers. Satisfactory dealer connections which have been established for many years will be retained and new connections made in all other sections of the country. Stocks that have been carried at strategic points will be transferred

to the Universal Crusher Company's own agents. These stocks will be kept complete and up-to-date so that Universal crusher owners or prospective users are assured of prompt and efficient service.

The manufacturers of welded wire fabric reinforcement announce the establishment of the Wire Reinforcement Institute, with headquarters in the National Press Building, Washington, D. C. The purpose of the Institute is to provide a centralized organization to exploit the technical and utilitarian merits of wire as used for concrete reinforcement. Sponsored and supported by the several companies engaged in the manufacture of Welded Wire Fabric, yet wholly independent of the commercial interests of any single manufacturer, the Institute will function as a purely promotional organization, its activities including the assembly and dissemination of authentic information, data and statistics relevant to welded wire fabric and its uses. The activities of the Institute will be conducted under the direction of Royall D. Bradbury; formerly Instructor in Structural Design at the Massachusetts Institute of Technology; later, Vice President in charge of the Welded Fabric Department of the Clinton Wire Cloth Company, the concern that first produced Welded Wire Reinforcement; and recently, Contract Manager of the Abertaw Construction Company of Boston.

Announcement is made by the Wire Reinforcement Institute, Washington, D. C., of the appointment of James S. Burch to the position of Research Engineer. Mr. Burch's recent connection

with the technical staff of the American Road Builders' Association as Investigator for the Association's Special Committee on Subgrades and Pavement Bases has brought him many friends among highway officials in all parts of the United States.

CIVIL SERVICE

Engineering Inspector-Superintendent-Foreman

Applications for principal engineering inspector-superintendent and senior engineering inspector-foreman must be on file with the U. S. Civil Service Commission at Washington, D. C., not later than March 25, 1931. These examinations are to fill vacancies in the Bureau of Public Roads, Department of Agriculture, for duty in the field. The entrance salaries for principal engineering inspector - superintendent range from \$2,300 to \$2,900 a year; for senior engineering inspector-foreman they range from \$2,000 to \$2,600 a year.

Competitors will not be required to report for written examination. They must have been graduated in civil engineering from a college or university of recognized standing, and must have had certain additional education or experience.

Information.—Full information may be obtained from the United States Civil Service Commission, Washington, D. C., or from the Secretary of the United States Civil Service Board of Examiners at the post office or customhouse in any city.

Itemized Costs of Construction

Bridge Mains and Connecting Lines Portland, Ore.

Bids Opened Dec. 29

	(1)—A. Guthrie & Co.	(2)—Kern & Kibbe.	(3)—NePage-McKenny Co.	(4)—Jacobsen-Jensen Co.
	(1)	(2)	(3)	(4)
7900 c. y excavation	\$1.75	\$0.90	\$0.65	\$0.80
30 c. y concrete	12.00	18.00	12.00	20.00
1250 s. y. cutting pavement etc.	5.25	3.00	1.90	2.50
1625 tons cast iron pipe	51.50	50.00	58.50	52.36
30,000 lbs. C. I. pipe specials .....	.0725	.07	.10	.10
66,500 lbs. spec. castings .....	.07	.06	.09	.10
46 24-inch cast steel flanges	44.00	33.00	25.00	40.00
4500 l. f. 24-in. I. D. steel pipe	5.00	6.15	5.10	6.00
172 24-in. couplings	30.00	17.50	17.00	30.00
230,000 lbs. structural steel .....	.09	.1075	.075	.10
4 steel inspec. carriages	350.00	252.00	180.00	300.00
4 expansion joints	430.00	400.00	325.00	400.00
5 6-inch gate valves	12.00	25.00	6.00	10.00
3 30-inch gate valves	60.00	80.00	35.00	30.00
1 gate chamber (Division St.)	350.00	350.00	250.00	600.00
1 gate chamber (Ross Island Bridge) ..	600.00	400.00	550.00	800.00
1 gate chamber (Grand Av.)	350.00	350.00	250.00	600.00
350 lin. ft. 44-inch culvert pipe	8.00	12.00	10.50	15.00
3 brick air valve chambers	150.00	100.00	100.00	60.00
5 2-inch air valves	40.00	30.00	41.00	40.00

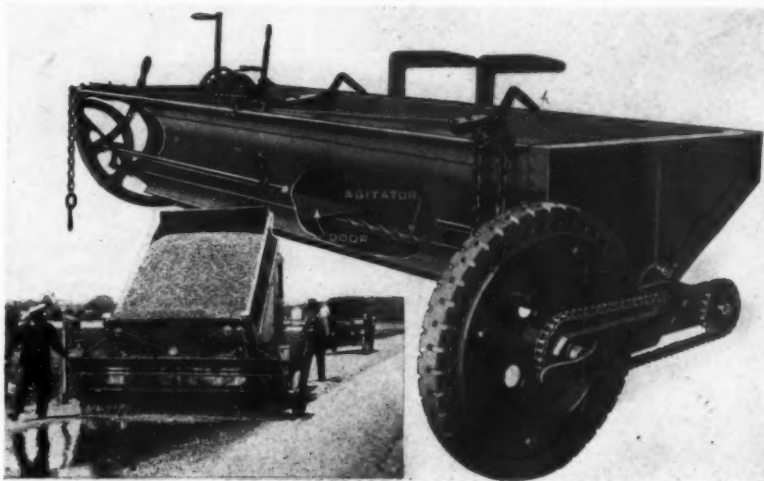
NePage-McKenny Co., low bidder at \$163,516.50.

New Ideas for the Engineer and Contractor

A Simple Mechanical Spreader

The N. & H. mechanical spreader is of very simple design and will fit any standard truck. One man can attach and detach the machine easily and rapidly.

The weight of the spreader and load is carried by the truck, giving the truck a free move in either direction. Material may be spread with truck moving forward or backward. There are hinged doors that permit variable widths of materials to be spread from 6 inches to 9 ft. A lever provides for controlling the amount of material to be discharged. A twisted agitating shaft giving uniform force feed is powered by an auxiliary wheel. Slag, stone, sand and gravel can be handled.



The N. & H. spreader for sand and gravel.

New I-R 500-Cu. Ft. Portable Compressor

Ingersoll-Rand Co. announces a new portable air compressor with a piston displacement of 500 cu. ft. per minute. This unit not only has a capacity 60 per cent greater than the largest portable previously offered, but follows a type of design that is distinctly different from that of smaller machines. It is designated the Type "XL."

The unit consists of a two-stage, horizontal compressor direct-connected to a 4-cylinder, 4-cycle Waukesha gasoline engine through spiral bevel reduction gears operating on ball bearings.

Two complete water cooling systems are provided—one for the compressor and one for the engine. Separate, automatic lubricating systems also are used. A radiator-type intercooler cools the air between the stages of compression. Regulation is automatic.

The complete unit with gasoline tank and receiver is mounted on a one-piece cast steel frame, equipped with rubber-

tired steel wheels. The steel top is fitted with removable steel side covers arranged for locking.

The Type "XL" is intended for use on jobs which require a considerable amount of air. It will do the work of two or more small portables, with resulting savings in operating costs and space requirements.

New PH Equipment: The Slide Comparator

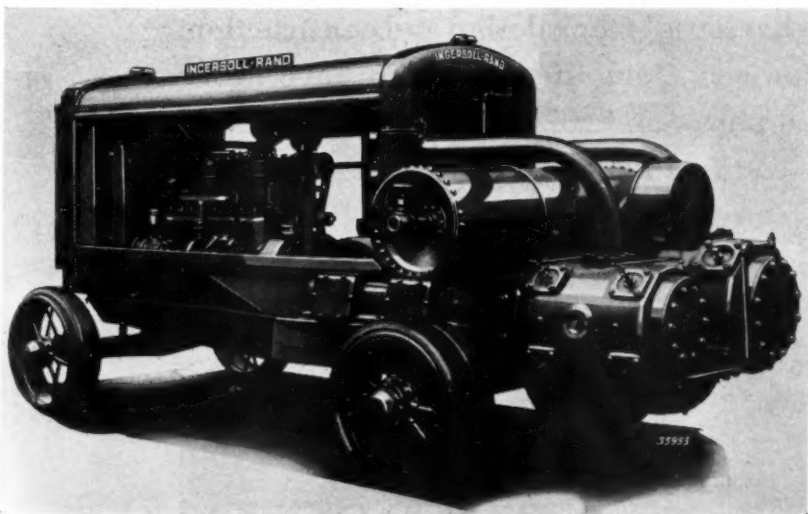
W. A. Taylor & Company, Baltimore, Md., has developed a new slide comparator molded from Bakelite. It consists of two principal parts, the slide and the base. The base is a Bakelite case 10 inches long, 2 3/4 inches high and 5/8 inch thick. The base consists of two parts. The lower part contains a slot in which the slide may be moved back and forth. The upper part of the base serves as a cover for the vials and test tubes when the set is not in use.

Determinations are made simply by sliding the color standards in front of the test sample until a color match is obtained. The operation of the set is extremely simple so that it is possible to teach a workman to use the set accurately with a few minutes instructions. Slide comparators are supplied to cover the pH range 0.2-13.6. Each comparator covers a range of 1.6 pH units, the standards being intervals of 0.2 pH. Free folder will be sent on request by the manufacturers or by Public Works.

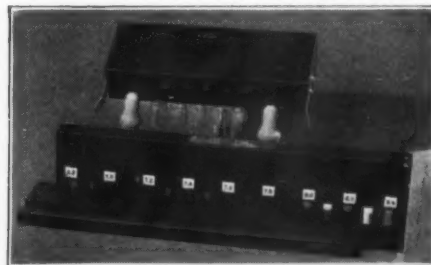
The Euclid Improved "Track-Wheel"

As a result of extensive tests, intensive research and wide experience the Euclid Crane & Hoist Co., Wagon Division, has developed a crawler type wheel which, it is claimed, will wear at least twice as long as the older models.

The shoe is wider and stronger; it has larger openings in the box section, interlocking surfaces designed to eliminate excessive wear; thicker rail; specially hardened steel bushings (easily removed and economically replaced); harder and tougher shoe pins, carefully ground to give closer accuracy, straightness and longer life; and a much larger arch, insuring still lighter draft than ever before.



Ingersoll-Rand type XL portable compressor of 500 cu. ft. piston displacement.



The Taylor comparator is molded from Bakelite.



REO Fulfills Every Need of Reliable Road Making Haulage

The Reo is the fastest and most easily driven of full-sized commercial vehicles having all-truck design and construction. ¶ Reo records of low-cost, long-life operation have never been disputed. ¶ Reo power and ruggedness, Reo safety and control, Reo riding comfort and saving of driver fatigue—are advantages operators seek and appreciate. ¶ Moreover, Reo-designed bodies are perfectly suited to road making haulage needs and possess the advertising asset of fine appearance. REO MOTOR CAR COMPANY, LANSING, MICHIGAN

SPEED WAGONS REO AND TRUCKS

When writing, please mention PUBLIC WORKS

Recent Developments in Apparatus

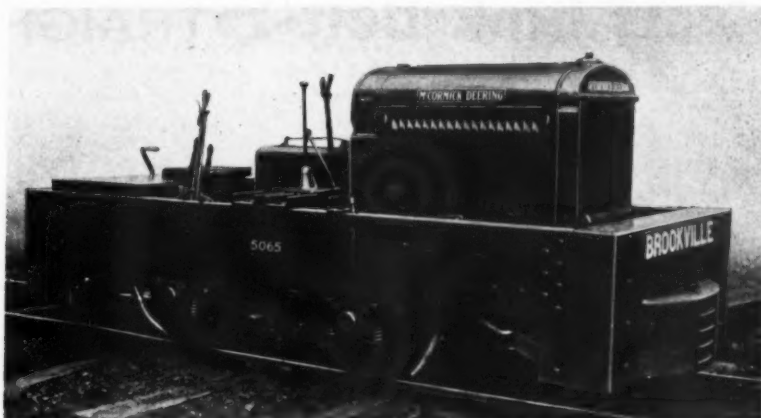
Brookville Locomotives With McCormick-Deering Power

The Brookville Locomotive Company offers two new models: the 8-ton BMD-8 and the 10-ton BMD-10, each of which is powered by the McCormick-Deering Model "300" Industrial power unit, accompanied by a five speed transmission and a clutch also manufactured by the International Harvester Company. In accordance with the policy followed in designing all Brookville locomotives, these standard units are installed in the chassis without alteration. As a result, the entire power plant and transmission can be serviced at any International Harvester Company branch.

Speeds from 2 to 16 miles per hour are available for saving time on the run and the gears can be shifted while the load is under momentum.

For maximum traction the use of Brookville Renewable Steel Tires is recommended. These provide 25 per cent greater traction and, consequently, 25 per cent greater pulling power than do ordinary chilled face drive wheels. Even though these steel tires be used, all Brookville Locomotives are sufficiently powerful to slip all four wheels on a dry sanded rail.

The BMD-8 and BMD-10 are available in any gauge from 22" to 56½", or wider; and equipped with either four pocket link and pin type couplers or with MCB couplers for use with standard freight cars. Wheelbase, overall height and other dimensions are variable, within limits, to suit requirements.



Brookville locomotive with McCormick-Deering power.

The hydraulic control gives the operator the ability to control instantly and vary the cutting depth, by merely shifting a lever from the seat. This instantly variable adjustment and the use of a narrower but deeper bowl, makes loading easier, and permits hauling of larger capacities with the same power unit. It also eliminates delays from the tractor stalling due to variation in soils while loading. It also makes it possible to rotate the bowl backwards after loading on its carrying runners to carry the load rather than to drag it. It also permits spreading in instantly variable depths. The load may be dumped in one pile, or spread in any desired layers. This scraper may also be backed up if desired.

cable method. The use of chisel and sledge was inadvisable, due to the weakness of the stack.

A welder was called in. He found that it would be impossible to work from the outside of the stack because the ladder had rusted away and fallen off. To overcome this, a four-post scaffold was erected inside the stack, which was 10 ft. in diameter, with a bell 15 ft. in diameter at the top.

Starting at the top, the operators cut out pieces 4 ft. long and 6 inches wide with their oxy-acetylene blowpipes. These pieces were of convenient size for lowering the power-house roof below.

Work progressed this way until the height of the stack had been reduced to 130 ft. Then, in order to attach a new ladder, angle iron braces were bolted to the stack from top to bottom and the ladder replaced. New boltholes were quickly cut with the blowpipe.

When the job was finished, the master mechanic of the sugar company was thoroughly satisfied with the work, and declared that it would have been almost impossible had any other method been used.

Hydraulic Roll-Over Scraper

A recent addition to the LaPlant-Choate line of equipment for use with "Caterpillar" tractors is a hydraulic Roll-Over scraper. This scraper is in general design, similar to the conventional type of Roll-Over scraper. The following advantages are claimed for it:

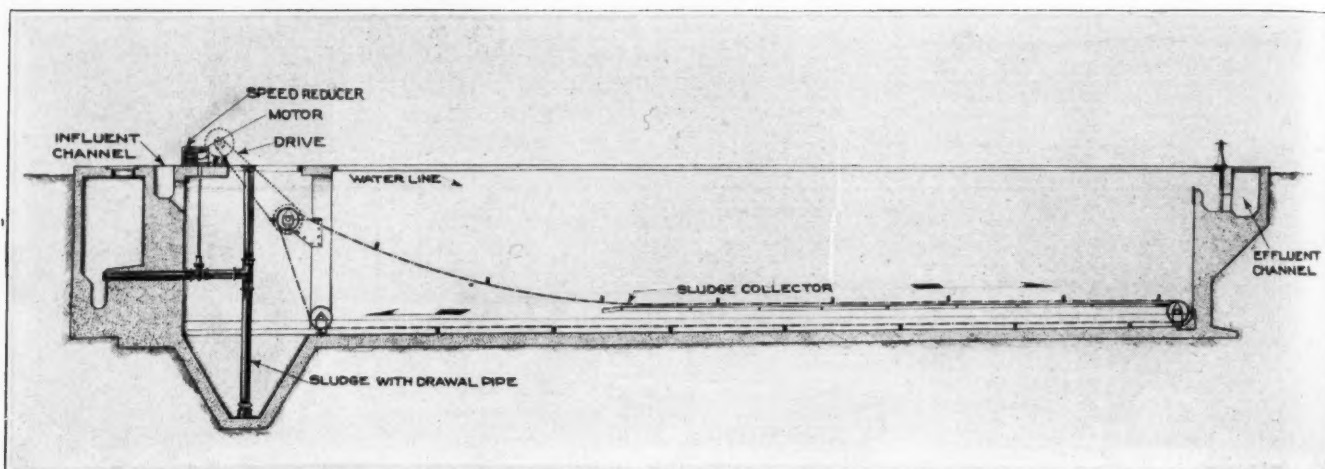
Rusted Smoke Stack Demolished With Blowpipe

Faced with the problem of cutting off the top 60 ft. of a 190 ft. smokestack which rust had so weakened as to render it unsafe, the owners of a mid-Western factory decided that oxy-acetylene cutting was the only practi-



The cutting depth, spreading depth, time and method of dumping is easily controlled on the new LaPlant-Choate Roll-over scraper.

St. Louis County Water Works Co. Selects Link-Belt STRAIGHTLINE Collectors



Settling Tanks at the Plant of the St. Louis Water Works Co.
Albright & Mebus (Philadelphia) Consulting Engineers.

Reliability

is the principal reason for the selection of Link-Belt STRAIGHTLINE Collectors for the primary settling tanks at the St. Louis County Water Works. (Albright & Mebus, Consulting Engineers).

Twelve collectors remove the sludge from six tanks, each 37'-0" wide 15'-0" deep and 150'-0" long. The speed may be varied from 3" to 18" per minute. Removal of the settled sludge is positive and certain. Neither the large volumes of sludge—carried at times by the Mississippi River—nor severe weather conditions interfere with the continuous operation of Link-Belt STRAIGHTLINE Collectors.

Send for Book No. 642. Address the nearest office.

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Money Saving Methods

Contributions for this space are invited. We will extend your subscription one year, or if you are not a subscriber, put your name on the list for a year for every item you send us that we can use.

Saving Forms—and Time and Money

A new device pulls highway forms and pulls the stakes with the forms. This not only saves time but eliminates damage to the forms from prying or bending and to the stakes from bending. It is claimed that two men using these pullers can pull 1000 feet of forms an hour.

This piece of equipment is made by the Moritz-Bennett Corp., Effingham, Ill.

Saving Money on Crack Filling

Better quality of work and much lower cost are claimed for the Burch crack filler. It is stated that one man with this machine will do the work of six without it—not a timely claim perhaps, but one that will appeal to managers of reduced budgets. All that is required for operation is to fill one tank with hot tar or asphalt and the other with stone chips. The chips are dropped a few inches behind the bitumen, and while it is still hot, so they will not pick up under traffic. The operator has complete control of the flow of material.

Fast and Accurate Weight Loadings for Trucks

In actual operation at Brockton, Mass., a Barber-Greene loader with weigh hopper was able to load trucks consistently at a rate of three 1,100 lb. batches in 50 seconds, the operator in each case coming within 3 pounds of exact weight.

The loader on which this weigh hopper is mounted is the new Barber-

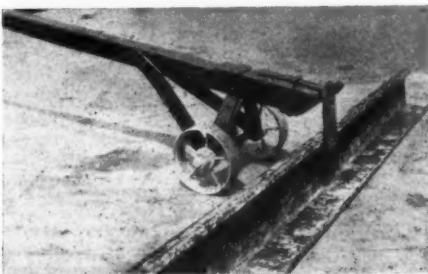
Greene Model 62 Super bucket loader. It is equipped with a dial-scale weigh hopper that will weigh within .4 of 1% of absolute accuracy even while the bucket loader on which it is mounted is operating at an angle of 4°. The Model 62 Loader is a crawler-mounted, self-feeding, one-man operated machine with a capacity of 62 cubic feet per minute.

The weighing unit built into this hopper is an American Kron Scale. The dial on the scale is graduated into two-pound units and is provided with two markers which may be set to indicate the desired reading.

Saving by Welding on Pipe Lines

A new method of oxy-acetylene welding known as the Lindeweld process has been introduced by The Linde Air Products Company, New York, N. Y. This process is being used increasingly because of the remarkable speed and economy which it has made possible.

In the welding of pipe for oil and gas transmission, it has resulted in sav-



Moritz-Bennett Form Puller

ings of from 30 to 60 per cent of the time required to make a weld by the methods previously employed, depending upon the size of the pipe. Oxygen and acetylene consumption have also been reduced considerably.

Consistently higher strength welds are obtainable than by any welding process previously employed so that no



Fig. 1. Cold bend made in 20-inch pipe line welded by Lindeweld process.

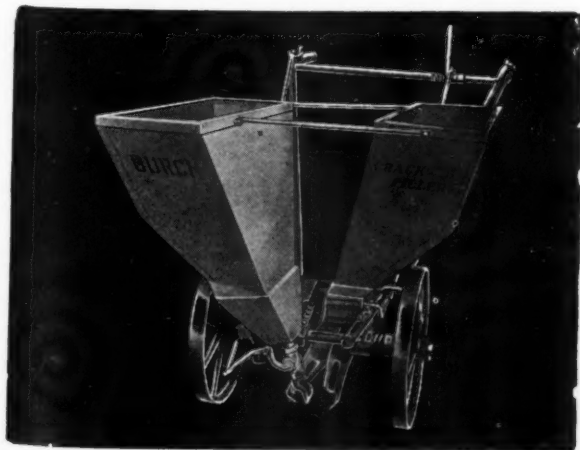
sacrifice of quality has been made for the benefit of the increased speed. In tensile tests made in the field on specimens welded by the Lindeweld process, the welds have invariably outpulled the pipe. Good ductility has also been shown in bend tests. More than 300 miles of high pressure pipe line welded by this process are now in the ground. Fig. 1 shows a 20-in. diameter natural gas pipe line which has been welded by the Lindeweld process being cold bent to fit the contour of the terrain. Cold bending of pipe of this size to such an extent is a good test of the strength and ductility of the welds.

Powermatic Unit Speeds Trucks

The Griswold Powermatic Corporation of Detroit has attacked the trucking problem from the angle of greater delivery speed. The Powermatic unit increases truck efficiency by reducing loading and unloading time. The unit operates directly from a conventional transmission power take-off without any necessity of the driver leaving his seat. It is capable of loading 5 tons and will unload 7 tons with ease. It is adaptable to all makes of trucks. Quick acting jacks at the rear of the truck frame relieve the truck axle of all unloading strains.



Barber-Greene, Model 62 loader with weigh hopper is shown at the right. It has a capacity of 62 cubic feet per minute and is claimed to be accurate within 0.4 of 1%.



The Burch crack filler, shown above, does the whole job in one operation.

Equipment for Construction Economy

Unusual Spray Outfit in Washington, D. C.

The Maintenance Department of Washington, D. C., has purchased an outfit designed to spray cut-back as a paint or black base on concrete foundations before applying either asphalt, asphaltic concrete, or any other bituminous top. This spraying distributor can also be used for spraying emulsions and even straight asphalt when necessary.

The burner is provided on this particular outfit so that the cut-back can be warmed up when it is too cool to run freely.

It is an air-operated outfit, and an air compressor which is driven by means of an air-cooled engine is provided. A pop-off valve is furnished to keep the pressure at 40 lbs. at all times. Special arrangement is made to use this air also to blow out the hose lines when the jobs are finished.

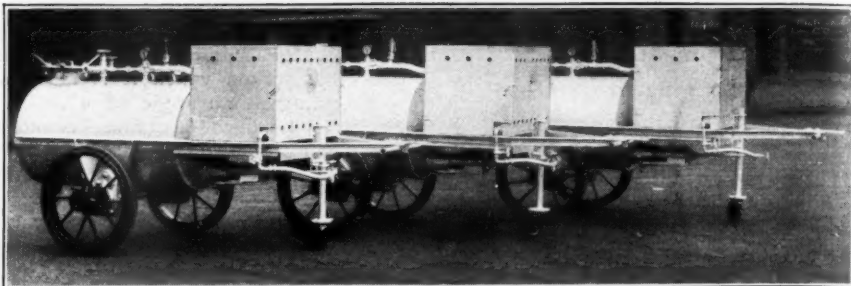
The outfit was manufactured by Littleford Bros. Co., Cincinnati, O.

Barber-Greene Small Bucket Loader

A new small bucket loader that will operate inside a box car and will handle any bulk material with lumps not exceeding four inches at the rate of $\frac{1}{2}$ yard per minute has been brought out by the Barber-Greene Company of Aurora, Illinois.

The new loader is wheel mounted and self-feeding and is powered by a 5 h.p. 1,800 r.p.m. ball bearing electric motor. The motor is totally enclosed in the machine, and fan cooled.

This model 63 bucket loader was originally designed for unloading bulk cement from box cars, but its use extends to handling grain, fertilizer, Fullers earth, nut and slack coal, silica, and other bulk materials, and loading



A Littleford spraying outfit for applying cutback on concrete bases.

wheelbarrows, buggies, or conveyor hoppers.

When in working position, the new loader is only 7 feet high, 6 feet, 9 inches long, and 4 feet wide.



The Barber-Greene small bucket loader will operate inside a box car.

1931 Link-Belt Crawler Loader

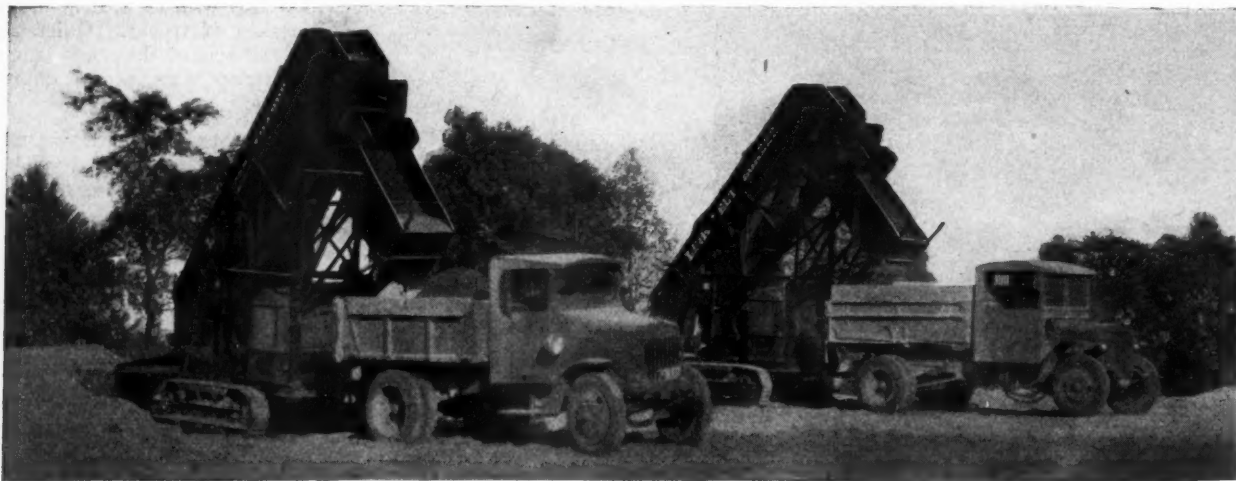
Link-Belt Company, Philadelphia, Penna., announce the 1931 Model Link-Belt Grizzly Crawler Loader, which is fully described in folder No. 1256, just published. It has the improved helical ribbon type feeder, announced in 1930, with its cast steel spiral which digs, lifts and conveys the material to the buckets, cutting a 7'-7" wide swath in the material handled.

The elevator has a rated capacity of $1\frac{3}{4}$ cubic yards per minute, with uniform feed, based on sand, stone and gravel, $1\frac{1}{2}$ " and smaller; run-of-mine bituminous coal or coke, etc.

A three speed transmission gives the crawlers a speed of 30-ft. per minute, or 66-ft. per minute, in the digging direction, and 27-ft. per minute in reverse.

Driving machinery is housed in a dust tight casing, partly filled with oil.

The Protective Value of Independent Inspections.—The Pittsburgh Testing Laboratory has published an interesting and valuable booklet discussing the value of a careful inspection of materials, especially in these times when competition has increased to such a point as to reduce or eliminate profits on many jobs.



The Link-Belt crawler loader at work charging trucks.

Free Industrial Literature

You can obtain the bulletins listed on this and the following pages by using the form at the bottom of this page or by writing to the Company direct, giving the booklet number and mentioning PUBLIC WORKS.

Construction Methods and Equipment

Accessories, Motor Truck

1. Truck accessories—winches, power take-offs, derricks, special bodies, earth boring machines, and trailers of all capacities are described in a series of folders issued by the Four Wheel Drive Auto Company, Clintonville, Wisconsin.

Asphalt Heaters

8. A 54-page booklet issued by Littleford Bros., 452 E. Pearl St., Cincinnati, Ohio, describes and illustrates oil, wood and coal burning asphalt and tar kettles, tool heaters, sand dryers, tool boxes, traffic line markers, grout mixers, asphalt tools and their use in road construction.

9. "Hotstuf," the master oil burning heater, is the only heater with patented elevated melting chamber for Asphalt, Tar and all bitumens used in road and street construction and maintenance, roofing, water proofing, pipe coating, etc. Described in illustrated manual No. 11—Mohawk Asphalt Heater Co., 94 Weaver St., Schenectady, N. Y.

Asphalt Plants

10. J. D. Farasey Mfg. Company, Cleveland, Ohio, issue a booklet for use and specifications for Farasey Portable Asphalt Paving Plants. These R. R. 1-car plants have easy capacity of 2,250 yards, 2" surface per 8 hours. Cheap to operate.

Asphalt Rollers

12. A 16-page booklet printed in two colors gives full details and specifications of the Erie Roller. Also explains how to use it to save tamping costs. Numerous action pictures. Issued by the Erie Machine Shops, Erie, Pa.

Chip Spreaders

25. The Universal Road Machinery Company of Kingston, N. Y., have issued a booklet describing their Reliance Chip Spreader, a special trailer, operating in the reverse direction, designed for resurfacing bituminous highways. Spreads to a width of 8' to any desired thickness.

Concrete Accelerators

30. "How to Cure Concrete," a forty-seven page manual published by the Dow Chemical Company, Midland, Michigan, treats fully the subjects suggested by its title. A well-illustrated and instructive volume.

31. "Curing Concrete Roads with Solvay Calcium Chloride," 30 page booklet. Comprehensive. Contains tables, illustrations, suggestions for testing devices. Covers the subject in considerable detail. Published by the Solvay Sales Corp., 61 Broadway, New York, N. Y.

35. "A report on Current Practice of using Calcium Chloride for curing Concrete Pavements, Building Construction, Bridges, Culverts and Concrete Products." Concise practical data, embodies latest information on subject. Issued by Columbia Products Co., Barberton, Ohio.

Concrete Mixer

44. Concrete Mixers. A 32-page booklet published by the Jaeger Machine Co., 400 Dublin Ave., Columbus, Ohio.

Crushers

56. Pioneer Gravel Equipment Manufacturing Company, Minneapolis, Minnesota, publishes complete 80-page manual, showing blue print sketches of set-ups in pit or quarry of the eleven different sizes of Pioneer Crushing Plants.

57. Up-to-date information on Stone Crushers, Stone Spreaders, Unloaders, Drags and other contractors' equipment from the Gallon Iron Works & Mfg Co., Gallon, Ohio.

59. A new booklet has just been issued by the Universal Road Machinery Company of Kingston, N. Y., describing their full line of portable and stationary crushing, screening and washing units.

Drag Lines

61. Write for complete catalog on Pioneer Drag Line. Catalog shows cross section of Drum Unit with full description of Frame, Sheaves, Motor and Bucket.—Pioneer Gravel Equipment Mfg. Co., Minneapolis, Minn.

Dump Wagons, Spring Wind-Up

68. Bulletin W-30-J, just issued by Western Wheeled Scraper Company, Aurora, Illinois, illustrates and explains the new Western Automatic Spring Wind-up with which all Western Crawler dump wagons, either new or in service, can be equipped without requiring any attachment on the tractor. This device makes the employment of a wagon man unnecessary.

Dump Wagons, Steel

70. Steel Dump Bodies and hydraulic hoists for Fords and other small trucks are described and fully illustrated in technical literature published by the Wood Hydraulic Hoist and Body Co., 7924-60 Riopelle St., Detroit, Mich.

71. "Steel Dump Bodies." Full data on steel dump bodies for every type of hauling proposition and description of special "Self-Dumper Bodies" for road builders. Wood Hydraulic Hoist and Body Co., 7924-60 Riopelle St., Detroit, Mich.

Hoists, Truck

85. "Dump Truck Hoist." Double the Truck's value by using power operated Hydraulic Hoists. Catalog of WOOD Hydraulic Hoist and Body Company, Detroit, Michigan, describes Hydraulic Hoists for every make and model of Truck.

Hoppers, Measuring

86. The C. S. Johnson Co., Champaign, Ill., publish a booklet which describes the Johnson Demountable Bins and Measuring Hoppers. Data sent on request.

Hose and Belting

87. Complete information on rubber hose and belting for all types of contracting and road building service available from the Government Sales Department of the Goodyear Tire & Rubber Co., Inc., Akron, Ohio.

Lanterns and Torches

90. Send for interesting catalog in colors of Dietz Lanterns and Road Torches adapted for night traffic warning on any construction work that obstructs the highways. R. E. Dietz Co., 60 Laight St., New York, N. Y.

Loaders and Unloaders

96. Portable car unloaders save money for the contractor on road and other construction projects. Full information on this and on the Reliance Chip and sand spreader on request. Universal Road Machinery Co., Kingston, N. Y.

97. Link-Belt Company, Philadelphia, describes a line of Portable Loaders and Unloaders in Folders: No. 1073 and 1074 cover Belt Conveyors with channel iron and truss types of framework; No. 1076 Portable Bucket Elevators for different classes of work; and No. 1149, the "Grizzly" Crawler Loader for heavy work and large capacities.

Motor Trucks

107. "Trucks for Federal, State, County and City Governments," a booklet issued by Dodge Brothers, division of Chrysler Corporation, gives information about company's trucks in municipal, county, state and government activity.

108. Four-wheel-drive trucks to increase the range of truck operation and for economy of operation for use in road building and maintenance, described in a series of new folders just issued by the Four Wheel Drive Auto Company, Clintonville, Wisconsin.

Paving Materials

110. "Tarmac Cold Mix." Complete data and pictures on plant-mixed pavements laid cold. American Tar Products Co., Koppers Bldg., Pittsburgh, Pa.

111. "Tarvia Double Seal Pavements." Shows, step by step, the construction of a



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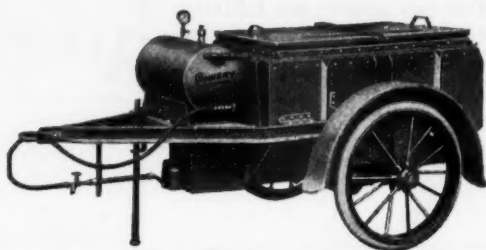
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Literature on request.

Headley Emulsified Products Co.

Philadelphia, Pa.

Tarvia pavement. Profusely illustrated with photographs, 24 pages. The Barrett Company, 40 Rector Street, New York.

Plows

112. Plows, Grade Rippers (Scarifiers) and Scrapers are fully illustrated in a new catalogue which will be sent upon request by Ward Plow Company, Batavia, N. Y. Oldest Plow manufacturers in America.

Power Graders

117. A large wall display piece, No. 3101, printed in three colors and containing a very large illustration of the WARCO Model "E" power grader as well as complete description and working views on center control graders will be sent by the W. A. Riddell Co., of Bucyrus, Ohio, to anyone interested.

Pumps, Contractors'

119. 'Domestic' Contractors' Pumps. Automatic Priming, Ball Bearing Centrifugals 2½" to 6" sizes. 'Giant' Road Pumps, 80 and 100 gallons per minute. Dependable Diaphragm and Plunger Trench Pumps and Holsts. Special Bulletins. Domestic Engine & Pump Co., Shipensburg, Pa.

122. Humdinger contractors' pumps. Diaphragm pumps in both the open discharge and the diaphragm force pump types. Self-priming Centrifugal pump, for automatic continuous prime on suction lifts up to 28'. Are described fully and valuable practical information for contractors is given in special Bulletins #107-A and 1034. Ralph B. Carter Co., 53 Park Place, New York, N. Y.

Road Construction

123. "Road Construction and Maintenance" are covered in a new Cletrac Booklet, which takes up such subjects as modern methods of handling large capacity equipment, tandem equipment, etc. Cleveland Tractor Co., 1932 Euclid Ave., Cleveland, Ohio.

Road Rollers, Scrapers, Graders, etc.

125. Plows, Grade Rippers (Scarifiers) and Scrapers are fully illustrated in a new catalogue which will be sent upon request by Ward Plow Company, Batavia, N. Y. Oldest Plow manufacturers in America.

126. Illustrated catalogs and descriptive material HERCULES All-steel, 6-cylinder road roller. 60 H.P. Gasoline engine. Sizes 5, 7, 8, 10, 12, and 15 tons. Three speeds forward and backward. Cast Steel rollers. The Hercules Company, Marion, Ohio.

127. A 16-page booklet printed in two colors gives full details and specifications of the Erie Roller. Also explains how to use it to save tamping costs. Numerous action pictures. Issued by the Erie Machine Shops, Erie, Pa.

128. A beautiful 32 page book in four colors featuring their entire line of road rollers has been published by the Buffalo-Springfield Roller Co. of Springfield, Ohio. 8½ x 11, leatherette cover, numerous action pictures.

131. 20-page pocket size booklet showing all types of Buffalo-Springfield motor rollers and scarifiers. The Buffalo-Springfield Roller Company, Springfield, Ohio.

132. "Road Machinery." A sixty-four page data book has been issued by the Austin-Western Road Machinery Company, 400 No. Michigan Ave., Chicago, describing their full line of road building machinery. Included in it are illustrations and descriptions of road graders, 5-foot blade to 12-foot blade; road rollers, steam or gasoline powered, 3 to 15-ton single cylinder to four cylinder. Motor graders, three sizes. Scarifiers. Crushing plant equipment, small road tools. Special bulletins on each separate piece of machinery supplement the general catalog.

133. "Road Rollers." New illustrated booklets covering the entire line of Master 4-Cylinder motor roller, 4-cylinder tandem roller and International motor roller. Gallon Iron Works and Manufacturing Co., Gallon, O.

134. 36-page, illustrated book describing mechanical features of Huber 4-cylinder Motor Roller and its application to many types of road construction and maintenance. Huber Mfg. Company, Marion, Ohio.

135. Road Machinery Illustrated. New illustrated bulletins on the master Motor Roller, Three-Wheel and Tandem Rollers, Motor Graders powered by Caterpillar, Twin City, Cletrac, McCormick-Deering and Fordson tractors, and Straight and Leaning Wheel Graders. Gallon Iron Works & Mfg. Co., Gallon, O.

136. Full description of Huber Motor Rollers in sizes from 5 to 15 tons, included in durable 36-page book for use by road contractors and maintenance crews. Huber Mfg. Co., 345 E. Center St., Marion, Ohio.

Sand and Gravel Washing Plants

139. Up to date information on Portable Sand and Gravel Washing Plants with concrete capacities, ranging from 30 to 100 yards per hour.—Pioneer Gravel Equipment Mfg. Co., Minneapolis, Minn.

Screens

140. Full information concerning Shaker and Revolving Screens, Conveyors, Elevators, Bins and Chutes is contained in catalog and special illustrated folders on Pioneer line. Write Pioneer Gravel Equipment Mfg. Co., Minneapolis, Minn.

Shovels, Cranes and Excavators

141. Link-Belt Company, Chicago, in Book 1095, gives valuable information on Heavy Duty Crawler Cranes-Shovels-Drainages, ¾ to 2½-yard capacity, with full line of attachments—grab buckets, trench hoes, dippers, magnets, hook blocks, back-filler boards, grapples, pile drivers, etc.; also complete line of Locomotive Cranes and accessories.

142. The Cranemobile, "successor to Trench Cranes," an adaptation of the crawler mounted Bay City Tractor Shovel is fully described and illustrated in Bulletin C2 just issued by Bay City Shovels, Inc., Bay City, Mich.

145. Catalog K3 just issued, completely describes the light half yard and the full half yard convertible shovel, crane, dragline, trench hoe and skimmer manufactured by Bay City Shovels, Inc., Bay City, Mich. 28 pages, over 50 illustrations, action pictures and charts.

151. The complete line of ¼-yd. to 1½-yd. shovels, cranes, draglines, ditchers and skimmers manufactured by the Orton Crane & Shovel Co., 608 S. Dearborn St., Chicago, Ill., is described in Bulletin 60, which also gives lifting capacities and working ranges for the different sizes and types of these crawling tread machines.

Steel Forms

155. A well illustrated catalog of Steel Forms for concrete road, curb and sidewalk construction is available from The Heltzel Steel Form & Iron Company, Warren, O.

Steel Bins

159. Steel bins and measuring hoppers are included in a fully illustrated catalog of Contractors Equipment issued by The Heltzel Steel Form & Iron Company, Warren, Ohio. Write for your copy.

Steel Posts

160. Steel Posts for all purposes. Sweet's Herculean Steel Posts for highway guard rails, fences and other purposes. Catalog and data book. Sweet's Steel Company, Williamsport, Pa.

Tires, Truck and Car

165. Solid, cushion and pneumatic tires

and tubes for trucks, cars, tractors, graders and other road machinery. Full information and data available from Government Sales Department of the Good-year Tire & Rubber Company, Inc., Akron, Ohio.

Tractors, Crawler

169. Cletrac crawler tractors. Cleveland Tractor Co., 1932 Euclid Ave., Cleveland, O. Bulletin 562 describes their use in roadbuilding and maintenance, earth moving, excavating, grading, snow removal, oil field work and lumbering. Made in "20," "30," and "40" and "100" sizes.

170. "Roads," a series of five fully illustrated folders, prepared by the Caterpillar Tractor Co., of San Leandro, Calif., and Peoria, Ill., shows what Russell graders and "Caterpillar" tractors can do and are doing to build better roads quicker and cheaper.

171. The design, construction, details and complete specifications of the new Ten and Fifteen models "Caterpillar" are given in a booklet recently published by the Caterpillar Tractor Co. of San Leandro, Calif., and Peoria, Ill.

173. Cletrac Crawler Tractors are built in a complete line by The Cleveland Tractor Company, 19322 Euclid Ave., Cleveland, Ohio. Cletracs range in size from the 12 h. p. model to the powerful 100 h. p. tractor.

Tractors, Wheel

175. "Huber Tractors" and "The Huber Motor Rollers." Illustrations of machines in operation and testimonials from users. The Huber Mfg. Co., 345 E. Center St., Marion, Ohio.

176. "Kerosene Power, the Low-Price Road Builder," book of data by the International Harvester Co., 606 So. Michigan Ave., Chicago, shows economy of kerosene tractors. Illustrations, specifications and figures on cost of operation.

Truck Cranes

182. Full-revolving, gasoline-operated Truck Cranes with a capacity of 7½ tons at a 10 ft. radius, for mounting on a 5-ton or 7½ ton auto-truck, are described in Bulletin 62, issued by the Orton Crane & Shovel Co., 608 S. Dearborn St., Chicago, Ill.

Truck Hoists

183. "Dump Truck Hoists." Double the Truck's Value by using power operated Hydraulic Hoists. Booklet published by WOOD Hydraulic Hoist and Body Company, 7924 Riopelle St., Detroit, Michigan, describes Hydraulic Hoists for every make and model of Truck.

Wheeled Scoops

190. The WARCO wheeled scoops, claimed to offer the most economical handling of earth on short hauls, is fully described and illustrated in Bulletin No. 3102 issued by the W. A. Riddell Co., of Bucyrus, Ohio. Printed in three colors and fully illustrated—will be sent to anyone interested.

Road and Street Maintenance

Asphalt Heaters

201. Tar and Asphalt Kettles, Oil Burning Kettles, Pouring Pots, Torches and Hand Spraying Attachments. Full data. Connery & Company, Inc., of Philadelphia.

202. Connery & Company, Inc., 3900 N. Second St., Philadelphia, Pa., has issued a new Bulletin "J" describing the latest and improved style "J" Oil Burning Kettle for Paving Contractors, Street and Highway Departments.

203. A 54-page booklet issued by Littleford Bros., 452 E. Pearl St., Cincinnati, Ohio, describes and illustrates oil,

Combining Superior Strength with Maximum Durability and Resistance to Weather and Storms—

SWEET'S STEEL POSTS

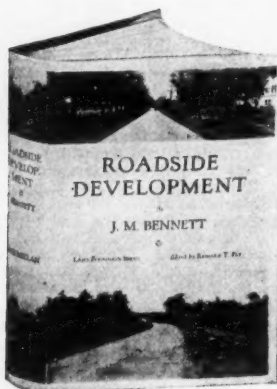
are ideally adapted for your caution or warning signs, highway route markers, street or road intersections signs, etc.

Sweet's Steel Co.

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Williamsport, Pa.

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By J. M. Bennett

Based on 10 years' actual experience and supervision of work costing millions of dollars, this new book by J. M. Bennett is invaluable to

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102 Illustrations

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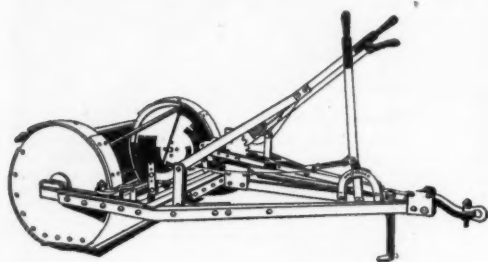


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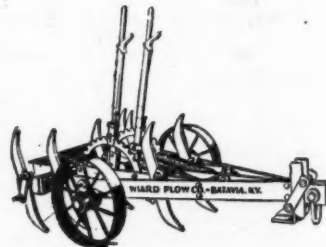
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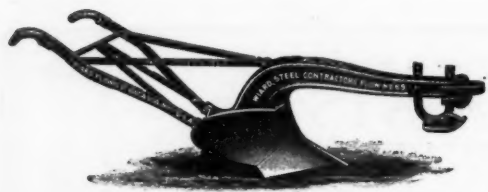
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wood and coal burning asphalt and tar kettles, tool heaters, sand dryers, tool boxes, traffic line markers, grout mixers, asphalt tools, etc.

Dust Control

210. "How to Maintain Roads," by the Dow Chemical Company, Midland, Michigan, is a manual dealing thoroughly with dust control, road building and maintenance. It contains tables and composition, grading, etc.

211. "Dust Control," a concise, handy pocket reference on control of dust by use of 3C Calcium Chloride. Illustrated. Issued by the Columbia Products Company, Barberton, Ohio.

Dust Laying

213. Solvay Sales Corporation, New York, supplies full information regarding the use of Solvay Calcium Chloride for effectively laying dust. The booklet, "Solvay Calcium Chloride, a Natural Dust Layer," 24 pages, 5½x8, covers application, economies, etc. Sent without cost.

Equipment

215. "Road and Street Maintenance Equipment," a compact vest pocket manual containing illustrations and brief descriptions of their extensive line, has just been issued by Littleford Bros., 452 East Pearl St., Cincinnati, Ohio.

216. "Light and Heavy Road Maintenance" is the title of a recent folder showing the tremendous power developed by the FWD truck and its economy for use in pulling road graders and maintainers—issued by the Four Wheel Drive Auto Company, Clintonville, Wisconsin.

Road and Paving Materials

Asphalt Plank

220. The Philip Carey Company, Cincinnati, Ohio, has available a handsome booklet describing Elastite Asphalt Plank for Bridge Flooring—with specifications for use—liberally illustrated with photographs.

Concrete Curing

235. "How to Cure Concrete," is a manual of instruction on the curing of concrete pavements. A handy, useful volume, well illustrated. 47 pages, 5½x7½. The Dow Chemical Company, Midland, Mich.

Culverts, Corrugated

236. The added advantage in using Toncan Iron Culverts under highways for airport drainage, storm sewers, suburban allotments, etc., because of Toncan's alloy composition, is described in bulletin—"We are living in the Alloy age"—Toncan Culvert Mfrs. Association, Massillon, Ohio.

Culverts, Large Diameter

237. The advantages of pipe culverts over open type bridges, and the latest approved practice of including detour, maintenance and operating costs in the total cost of a road or bridge project, are explained in the 16-page illustrated bulletin, "Applying Culvert Simplicity to Highway Bridge Requirements," issued by the Armco Culvert Mfrs. Association, Middletown, Ohio. Write for a copy of Bulletin H-31.

Culverts, Cost Comparisons

238. A 24-page illustrated booklet, "Selecting Culverts and Drains on the Basis of Cost per Year," reviewing the factors which, collectively considered, permit true cost comparisons between structures serving the same purpose, has been published by the Armco Culvert Mfrs. Association, Middletown, Ohio. Bulletin H-34 will be sent free on request. Write for it today.

Expansion Joint for Pavements

250. Premoulded Expansion Joints in several different types, including a new asphalt rubber joint, in order to meet various construction conditions are covered in literature issued by the Serviced Premoulded Products, Inc., 53 W. Jackson Blvd., Chicago, Ill.

251. Full information on the use of Expansion Joints in pavements, bridges, pools, walls and other concrete work, including best installation methods, may be obtained from The Philip Carey Company, Cincinnati, Ohio.

Maintenance Materials

267. "Mixed-in-Place Construction with Tarmac." Step-by-step pictures and specifications for constructing road surfaces by Retread or Turnover methods. American Tar Products Co., Koppers Bldg., Pittsburgh, Pa.

268. Road and street maintenance and reconstruction with BITUMULS Cold Asphaltic Binder described in an illustrated paper by C. H. Thomas, Maintenance Engineer. Reprints furnished by American Bitumuls Company, San Francisco or Baltimore.

270. "How to Maintain Roads," by the Dow Chemical Company, Midland, Michigan, is a manual dealing thoroughly with road building, maintenance and dust control. It contains tables of composition, grading, etc.

272. Preservation of Streets and Roads by the use of Road Oil, with many illustrations and testimonials from users. The Standard Oil Co. of Indiana, Chicago.

273. "Stanolind." Stanolind Paving Asphalt, a compound prepared by the Standard Oil Co. of Ind., is described in minute detail in booklet "Stanolind." Standard Oil Co. of Indiana, Chicago.

275. "Tarvia-K. P. for Cold Patching." An instructive booklet illustrating and describing each step in patching a road with "Tarvia-K. P." 16 pages, illustrated, 3½x9. The Barrett Company, New York.

276. "Road Maintenance with Tarvia." A 56-page illustrated booklet of value to every road man. Shows how almost every type of road and pavement can be repaired and maintained with Tarvia. The Barrett Company, New York.

277. "Tarvia." An attractively illustrated 32-page booklet describing grades of Tarvia and showing photographs of actual application. The Barrett Company, 40 Rector St., New York City.

278. Information regarding crack and joint fillers furnished in gray, black, or other colors, for poured joints, also maintenance and repair work may be obtained by application to the Serviced Premoulded Products, Inc., 53 W. Jackson Blvd., Chicago, Ill.

Rail Filler

281. Bituminous Rail Filler used for sound deadening, rail insulation and pavement protection is described in pamphlet issued by Serviced Premoulded Products, Inc., 53 W. Jackson Blvd., Chicago, Ill.

282. Write to The Philip Carey Company, Cincinnati, Ohio, for complete and interesting data on the application of Elastite Rail Filler in Street Railway Tracks.

Traffic, Street and Warning Signs

297. Data on "Early" street signs and sign posts. Describes adjustable method of fastening frame to staff, and illustrates porcelain enamel and other plates. Traffic and Street Sign Co., Newark, N. J.

Garbage and Refuse Disposal

305. "Pittsburgh-Des Moines Incinerator," built and guaranteed by the Pittsburgh-Des Moines Steel Company, 79 Neville Island, Pittsburgh, Pa., is described fully in a booklet sent on request.

Snow Removal

Snow Removal

348. "Winter Maintenance" is the title of a recent booklet issued by the Four Wheel Drive Auto Company, Clintonville, Wisconsin. Illustrates many types of snow plows and methods of handling snow removal problems.

349. "The Answer to the Snow Removal Problem" is the title of a new booklet just published by Carl Frink, Mfr., of Clayton, N. Y. It gives full details of the new Frink type S snow plow for trucks.

350. The W. A. Riddell Co., successors to Hadfield-Penfield Steel Co., Bucyrus, Ohio, has just issued new literature describing Fordson Snow Removers, and Hadfield-Penfield One-Man Graders.

353. Efficient methods of combating quickly the snow menace on highways and city thoroughfares. Illustrates joint use of crawler tractors and standard and spe-

cial snow plows. The Cleveland Tractor Co., 19322 Euclid Ave., Cleveland, Ohio.

354. "Snow Removal Equipment," a colorful booklet just off the press of the Caterpillar Tractor Co., of San Leandro, Calif., and Peoria, Ill. Various types of snow-fighting equipment built for "Caterpillar" Tractors are pictured in relief and in action.

358. The new Type "S" Frink Snow-Plows and Frink Leveling Wings, together with complete data for selecting the proper size snow plow for your particular make and model of truck. Published by Carl H. Frink, Clayton, N. Y.

359. Callon Iron Works and Mfg. Co., Gallon, Ohio, will gladly furnish details, prices and catalogs of their snow plows adaptable to any make of truck.

Sewerage and Sewage Disposal

Activation and Aeration

390. A new booklet describing Norton Porous Mediums of bonded fused alumina (strong, chemically stable, uniformly permeable), the booklet will be of interest to all chemical and sanitary engineers. Issued by Norton Co., Worcester, Mass.

Inlets and Manhole Covers

400. Cast iron sewer blocks, ventilators, manhole covers and inlets, valves, etc., described in pamphlet by the South Bend Foundry Co., South Bend, Ind.

Jointing Materials

401. G-K Compound for vitrified clay sewers, MINERALEAD for bell and spigot water mains, also M-D Cut-Ins for making house connections, described in catalogue of Atlas Mineral Products Company, Mertzstown, Pennsylvania.

402. An illustrated folder has just been issued by the Cochrane Chemical Co., 432 Danforth St., Jersey City, N. J., detailing the advantages and the savings in the use of Ex-XL-cell Sewer Pipe Joint Compound.

403. A recent publication of the Serviced Sales Company, Monadnock Block, Chicago, Illinois, tells of the superior tightness, flexibility and durability of fibrated asphalt Sewer Pipe Belts and Joint Compounds. Complete instructions and considerable data are included in the pamphlet, now available.

Pipe, Vitrified

405. Full information regarding Vitrified Pipe and other heavy clay products. Illustrated price list on application. Factories in Pennsylvania and Ohio. The Progressive Clay Co., offices in New York City, Philadelphia, Pa., and Syracuse, N. Y.

Sewage Screens

414. The Dorr Co., 247 Park Ave., N. Y., publishes Bulletin No. 6391, which describes the construction and operation of the Dorrco Mechanically-Cleaned Bar Screen.

415. Link-Belt Company, Philadelphia, shows in Book 642 its line of sewage screens (Tark, Brunotte, and Straight-line) for fine and coarse sewage; Straightline Collectors for Settling Tanks (Sludge, Scum and Grit; and Mechanical Aerators for activated sludge plants.

Sludge Bed Glass Covers

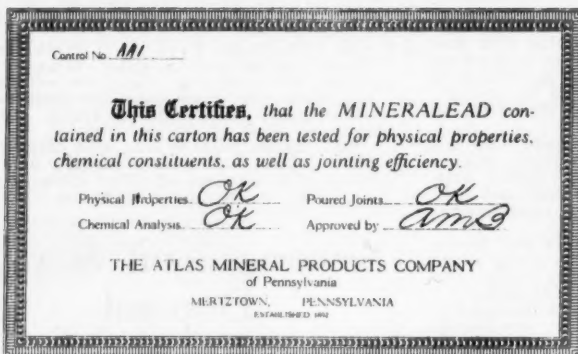
418. Sludge Bed Glass Covers—"Super-Frame" Hitchings & Co., Main Office, Elizabeth, New Jersey. Offer A. 1. A. File 101SB, Describing glass covers for sludge and sprinkler beds.

Sludge Bed Glass-Overs

421. The use of Lord & Burnham sludge bed Glass-Overs at Dayton, Ohio, are described in Subject No. 10. There are 11 Glass-Overs, each 60 feet wide and 163 feet long, covering 2½ acres. Lord & Burnham Co., Graybar Bldg., New York.

422. The use of Lord & Burnham sludge bed Glass-Overs at the Highland Park, Ill., sewage treatment plant are described in Subject No. 11. This is one of the smaller of the eight sewage treatment plants on the Chicago North Shore. Lord & Burnham, Graybar Bldg., New York.

423. Sludge Glass-Overs at Fostoria, Ohio, are described in Subject No. 14. At this plant the sludge removal carrier is supported directly on the roof construction. Lord & Burnham Co., Graybar Bldg., New York.

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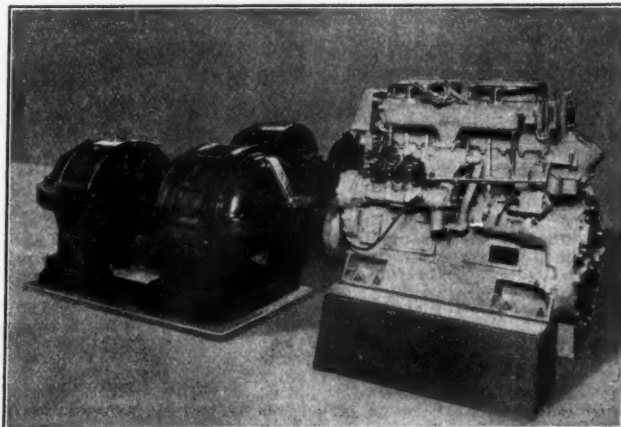
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Storm Sewers

424. A 24-page catalog, profusely illustrated with actual installations under widely varying conditions, which lists the features that give superiority to flexible corrugated metal construction for storm sewer installations, can be obtained from Armco Culvert Mfrs. Association, Middletown, Ohio. As for the catalog No. 5.

Treatment

425. Dorr Company, 247 Park Ave., New York, in its Sanitary Engineering bulletin describes the use of its equipment for treating municipal sewage, industrial wastes and water. Photos of numerous operating plants are shown as well as representative flow sheets illustrating the various methods of sewage treatment.

427. The Pacific Flush Tank Company, of Chicago and New York, publish eight separate catalogs on Sewer and Sewage Disposal Automatic Equipment, including pumps, Imhoff Tanks and Sewer Joint Compounds. These are of real value to the designer or operator of a treatment plant.

428. Advantages of Liquid Chlorine for disinfection given in booklet issued by the Electro Bleaching Gas Co., 9 East 41st St., New York.

429. Chlorine is being extensively used in the disinfection of sewage not only as a disinfectant but as an aid to other purification processes. Wallace & Tiernan Co., Inc., Newark, N. J., have a publication, No. 42, on the chlorination of sewage, which will be sent to any address on request.

430. The Dorr Co., 247 Park Ave., N. Y., publishes Bulletin No. 6171, which describes the treatment of sewage with Dorr Traction Clarifier, an improved type of continuous sedimentation for use in water and sewage treatment plants.

432. The Dorr Company, 247 Park Ave., N. Y. C., publishes Bulletin No. 6481, which describes the construction and operation of the Dorr Detritor for continuously removing and washing the grit from sewage flows.

434. Automatic, continuous vacuum filters, producing a relatively dry cake of sludge in demand for fertilizer, are used by: Milwaukee, Houston, Chicago, Gastonia, N. C., Charlotte, N. C., write for literature, Oliver United Filters, Inc., Federal Reserve Bank Bldg., San Francisco, Calif.

Water Works Equipment

Activation and Aeration

465. A new booklet describing Norton Porous Mediums of bonded fused alumina (strong, chemically stable, uniformly permeable), the booklet will be of interest to all chemical and sanitary engineers. Issued by Norton Co., Worcester, Mass.

Couplings and Tees

485. Copper pipe for water works services and patented connections for jointing to corporation stops, iron pipe, etc. Full data 22 pages 8½ x 11. The Mueller Co., Decatur, Ill.

506. "Mathews" Fire Hydrants. Gate Valves and other water works appurtenances. 16 pages, 7¼x10¼. R. D. Wood & Co., Philadelphia.

506. Hydrants, tapping apparatus, gate locks, valves and curb cocks described in a series of bulletins issued by A. P. Smith Mfg. Co., East Orange, N. J.

Jointing Materials

515. MINERALEAD for bell and spigot water mains, G-K Compound for vitrified clay sewers, also M-D Cut-Ins for making house connections, described in catalogue of Atlas Mineral Products Co., Mertztown, Pa.

Meter Boxes

525. Efficient installation and maintenance of water meters is described in catalog issued by H. W. Clark Company, Mattoon, Ill., manufacturers of Meter Boxes, Coupling Yokes, Meter Testers, Service and Valve Boxes.

526. An illustrated catalog covering meter boxes and specialties such as gate valve housing, curb boxes, meter testers, melting furnaces, jointing materials, four-in-one pumps, has recently been published by the Hydraulic Equipment Co., Reading, Pa.

Pipe, Cast Iron

534. "Sand-Spun," Centrifugal cast iron pipe manufactured by R. D. Wood & Co., Philadelphia, is fully described in a valuable 16-page 6x9 booklet, containing also complete specifications of this pipe. No engineer or water works official should be without this booklet.

535. Cast Iron Pipe and Fittings, sizes 1¼ through 12 inches, either with or without Precaulked lead joints factory-made in the bells. Data book sent free. The McWane Cast Iron Pipe Co., Birmingham, Ala. and Provo, Utah.

536. "Weights and dimensions of Cast Iron Pipe and Fittings." A handy reference book for Municipalities and Contractors. 48 pages, 7¼x10¼. R. D. Wood & Co., Philadelphia.

537. "Universal Cast Iron Pipe," for water supply, fire protection and sewage disposal. All jointing materials eliminated. Machined iron-to-iron joints made with wrenches only. (Booklet). The Central Foundry Company, 420 Lexington Ave., New York, N. Y.

538. "High Pressure Fire Protection Lines." Booklet containing excerpts from Underwriters report on Universal Cast Iron Pipe. The Central Foundry Company, 420 Lexington Ave., New York, N. Y.

539. U. S. Cast Iron Pipe Handbook contains useful tables and data for the Water Works man on pipe line construction. Issued by U. S. Cast Iron Pipe and Foundry Company, Burlington, N. J.

Pipe, Cement Lined

540. Steel or Wrought Iron Pipe lined with cement and special lead-lined joints, manufactured by the Cement Lined Pipe Co., of Lynn, Mass.

Pipe for Subdrainage

549. A revised 16-page well illustrated bulletin, "Increasing the Efficiency of Roadbed Drainage," containing information on the newest developments in the application of subdrainage to highway, municipal and public works construction—including frost boil prevention, landslide control and airport drainage. Ask for Bulletin H-30. Armco Culvert Mfrs. Association, Middletown, Ohio.

Pump Packing

575. "When Power Is Down," by the Sterling Engine Company, Buffalo, N. Y., gives recommendations of models for standby services for all power requirements.

Service Boxes

578. "Service Boxes with Stay-on Covers. No more broken covers. No more lost covers." (Booklet). The Central Foundry Company, 120 Lexington Avenue, New York, N. Y.

Storm Sewers

579. A valuable 24-page, 6x9 illustrated bulletin for city engineers and officials, entitled "Planning Municipal Drainage for Today and Tomorrow," has been published by Armco Culvert Mfrs. Association, Middletown, Ohio. Sent to anyone interested free on request.

Swimming Pools

580. Wallace & Tiernan Co., Inc., Newark, N. J., have just published a new edition of technical publication, No. 41, dealing with the sterilization of swimming pools by liquid chlorine. Copy sent on request.

Tanks and Stand Pipes

582. A 50-page booklet issued by Pittsburgh Des Moines Steel Co., 79 Neville Island, Pittsburgh, Pa., on complete water works plants, elevated tanks, stand pipes and filtration plants built by them.

Tapping and Valve Machines

583. The A. P. Smith Company, of East Orange, N. J., furnish descriptive matter dealing with their many labor saving devices as the Smith tapping machine, valve inserting machine and pipe cutting machines.

Miscellaneous

Airport Construction

597. "Getting on the Air Map With 'Caterpillar'," profusely illustrated with action pictures, describes the many uses of the tractor in building and maintain-

ing airports better, quicker, cheaper. Caterpillar Traction Co., San Leandro, Calif., and Peoria, Ill.

Airport Drainage

598. "Building Safety Into Airports—with Efficient Drainage Construction," a 24-page well illustrated booklet outlining the requirements for airport drainage has been published by the Armco Culvert Mfrs. Association, Middletown, Ohio. A copy will be sent to those interested free on request. Ask for Bulletin C-2.

599. The added advantage in using Toncan Iron Culverts under highways for airport drainage, storm sewers, suburban allotments, etc., because of Toncan's alloy composition, is described in bulletin—"We are living in the Alloy age"—Toncan Culvert Mfrs. Association, Massillon, Ohio.

Asphalt Bridge Planking

600. A new and improved asphalt composition has been developed as a long wearing and resilient paving material for bridges, viaducts, railroad platforms, etc., covered by Catalog No. 12, now available from Serviced Premoulded Products, Inc., 53 W. Jackson Blvd., Chicago, Ill.

601. The Philip Carey Company, Cincinnati, Ohio, has available a handsome booklet describing Elastite Asphalt Plank for Bridge Flooring—with specifications for use—liberally illustrated with photographs.

Asphalt Construction

605. Methods of mixing BITUMULS Cold Asphaltic Cement with natural soil or gravel for inexpensive landing areas and of constructing BITUMULS (cold) penetrated runways described in construction reports furnished by the American Bitumuls Company, 503 Market Street, San Francisco.

Community Advertising

610. Booklet showing various forms of publicity matter useful in arousing interest in the construction of small town water supplies. This matter is furnished free to Consulting Engineers and towns interested in waterworks construction by The Cast Iron Pipe Research Association, 566 Peoples Gas Bldg., Chicago, Ill.

Highway Crossings

612. A most serviceable and durable railroad crossing for city streets and main highways, is composed of fibrated asphalt planking and rail filler sections. Complete description and data will be furnished by Serviced Premoulded Products, Inc., 53 W. Jackson Blvd., Chicago, Ill.

Industrial Flooring

615. An extremely serviceable Fibrated recent contributions to industrial efficiency. Duo-Type Flooring—interlocking Asphalt Industrial Flooring is one of the sections with asphalt plank base and rubber block wearing surface offers a splendid combination of these products. Ask for pamphlets from Serviced Premoulded Products, Inc., 53 W. Jackson Blvd., Chicago, Ill.

Rules

625. The Lufkin Rule Company, Saginaw, Mich.; New York; Windsor, Canada. Manufacturers of Measuring Tapes, Boxwood Rules, Spring Joint Rules, Straight and Folding Steel Rules, Fine Mechanics Tools and Aluminum Folding Rules. General Catalog No. 11.

Tree Moving

632. "Tree Moving," folder from the Caterpillar Tractor Co., of San Leandro, Calif., and Peoria, Ill., shows and tells with action pictures and the letters of landscaping experts how to successfully move large trees.

Waterproofing and Dampproofing

635. Headley Emulsified Products Co., Philadelphia, has issued Bulletin 330, which gives some very valuable information regarding dampproofing, insulating, and waterproofing methods and materials for floors, walls, roofs, tanks, swimming pools, etc.

Waterproofing Protection Course

640. Fibrated Asphalt Waterproofing Protection Course planks as now used for protection course to membrane waterproofing on railroad structures, viaducts, large roofs, etc., is described in Catalog No. 12, issued by Serviced Premoulded Products, Inc., 53 W. Jackson Blvd., Chicago, Ill.

New Catalogs

Not described before in this
Industrial Literature Section

44. Jaeger Concrete Mixers, both Tilting and Non-Tilting types, from 3½ to 84s size, with illustrated descriptions of all types mounting, power and loading equipment—64 pages published by The Jaeger Machine Company, Columbus, Ohio.

Culverts—Large Diameter

60. Ease and speed of installation, economy, a full-width roadway and durable, maintenance-free service, are listed in the new catalog, "Armco Large Diameter Corrugated Pipe," as the advantages following the use of larger diameter culverts in meeting small bridge requirements. Catalog No. 8 will be sent free on request. Address Armco Culvert Mfrs. Association, Middletown, Ohio.

Finishing Machine

75. Complete description of Lakewood Finishers, showing use of single and tandem screeds and tamper attachment for high speed production on concrete and bituminous pavements, city streets and highways—32 pages published by The Lakewood Engineering Company, Columbus, Ohio.

Culverts—Corrugated Metal

233. A new 24-page, well-illustrated catalog, listing the advantages that follow the use of Armco corrugated iron culverts and containing complete instructions for ordering and installation has been published by Armco Culvert Mfrs. Association, Middletown, Ohio. Write for Culvert Catalog No. 6.

Jacking Method

260. No interruption to traffic, and substantial savings in construction costs are the main advantages secured by using the Armco jacking method to install conduits, drainage openings, and passageways under streets, highways and railroads. A new catalog, "The Armco Jacking Method," describing this modern means of construction and its many applications, will be sent upon request, by Armco Culvert Mfrs. Association, Middletown, Ohio. Ask for Catalog No. 7.

549. The benefits following the use of Armco perforated iron pipe for various municipal uses such as golf course, athletic field, and airport drainage; and its various applications in the construction and maintenance of highways and railroads are outlined in the 24-page illustrated catalog entitled, "Armco Perforated Iron Pipe." Catalog No. 4 is obtainable upon request from Armco Culvert Mfrs. Association, Middletown, Ohio.

Municipal Drainage Products

620. A complete line of drainage products which meets the modern municipal need for drainage materials that are quickly installed, safe, and dependable and economical in service is described in the new 24-page, illustrated catalog, "Armco Municipal Drainage Products." A request to Armco Culvert Mfrs. Association, Middletown, Ohio, for Catalog No. 9 will bring you this book free of obligation.

When You Want Catalogs

Consult the

Industrial Literature Section

and use the coupon on Page 99

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Huber Mfg. Co.		
Hydraulic Equipment Co.		
International Harvester Co.		

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